# OVERSIGHT HEARING ON PILOT PROGRAM TO CONTROL NUTRIA AT THE BLACKWATER NATIONAL WILDLIFE REFUGE IN MARYLAND

## OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

OF THE

## COMMITTEE ON RESOURCES
## HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTH CONGRESS

SECOND SESSION

JULY 16, 1998, WASHINGTON, DC

**Serial No. 105–97**

Printed for the use of the Committee on Resources

Available via the World Wide Web: http://www.access.gpo.gov/congress/house
or
Committee address: http://www.house.gov/resources

U.S. GOVERNMENT PRINTING OFFICE
50–341 CC WASHINGTON : 1998

## COMMITTEE ON RESOURCES

DON YOUNG, Alaska, *Chairman*

W.J. (BILLY) TAUZIN, Louisiana
JAMES V. HANSEN, Utah
JIM SAXTON, New Jersey
ELTON GALLEGLY, California
JOHN J. DUNCAN, JR., Tennessee
JOEL HEFLEY, Colorado
JOHN T. DOOLITTLE, California
WAYNE T. GILCHREST, Maryland
KEN CALVERT, California
RICHARD W. POMBO, California
BARBARA CUBIN, Wyoming
HELEN CHENOWETH, Idaho
LINDA SMITH, Washington
GEORGE P. RADANOVICH, California
WALTER B. JONES, JR., North Carolina
WILLIAM M. (MAC) THORNBERRY, Texas
JOHN SHADEGG, Arizona
JOHN E. ENSIGN, Nevada
ROBERT F. SMITH, Oregon
CHRIS CANNON, Utah
KEVIN BRADY, Texas
JOHN PETERSON, Pennsylvania
RICK HILL, Montana
BOB SCHAFFER, Colorado
JIM GIBBONS, Nevada
MICHAEL D. CRAPO, Idaho

GEORGE MILLER, California
EDWARD J. MARKEY, Massachusetts
NICK J. RAHALL II, West Virginia
BRUCE F. VENTO, Minnesota
DALE E. KILDEE, Michigan
PETER A. DEFAZIO, Oregon
ENI F.H. FALEOMAVAEGA, American Samoa
NEIL ABERCROMBIE, Hawaii
SOLOMON P. ORTIZ, Texas
OWEN B. PICKETT, Virginia
FRANK PALLONE, JR., New Jersey
CALVIN M. DOOLEY, California
CARLOS A. ROMERO-BARCELO, Puerto Rico
MAURICE D. HINCHEY, New York
ROBERT A. UNDERWOOD, Guam
SAM FARR, California
PATRICK J. KENNEDY, Rhode Island
ADAM SMITH, Washington
WILLIAM D. DELAHUNT, Massachusetts
CHRIS JOHN, Louisiana
DONNA CHRISTIAN-GREEN, Virgin Islands
RON KIND, Wisconsin
LLOYD DOGGETT, Texas

LLOYD A. JONES, *Chief of Staff*
ELIZABETH MEGGINSON, *Chief Counsel*
CHRISTINE KENNEDY, *Chief Clerk/Administrator*
JOHN LAWRENCE, *Democratic Staff Director*

---

## SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

JIM SAXTON, New Jersey, *Chairman*

W.J. (BILLY) TAUZIN, Louisiana
WAYNE T. GILCHREST, Maryland
WALTER B. JONES, JR., North Carolina
JOHN PETERSON, Pennsylvania
MICHAEL D. CRAPO, Idaho

FRANK PALLONE, JR., New Jersey
NEIL ABERCROMBIE, Hawaii
SOLOMON P. ORTIZ, Texas
SAM FARR, California
PATRICK J. KENNEDY, Rhode Island

HARRY BURROUGHS, *Staff Director*
JOHN RAYFIELD, *Legislative Staff*
CHRISTOPHER MANN, *Legislative Staff*

# CONTENTS

# OVERSIGHT HEARING ON PILOT PROGRAM TO CONTROL NUTRIA AT THE BLACKWATER NATIONAL WILDLIFE REFUGE IN MARYLAND

**THURSDAY, JULY 16, 1998**

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS, COMMITTEE ON RESOURCES, *Washington, DC.*

The Subcommittee met, pursuant to notice, at 2:15 p.m., in room 1334, Longworth House Office Building, Hon. Jim Saxton (chairman of the Subcommittee) presiding.

Mr. SAXTON. The Subcommittee will come to order for the purpose of conducting a hearing.

## STATEMENT OF HON. JIM SAXTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. SAXTON. The Subcommittee on Fisheries, Conservation, Wildlife and Oceans is meeting today to conduct an oversight hearing on a pilot program to control the non-indigenous species, nutria, which is destroying valuable wetlands in the Blackwater National Refuge in Cambridge, Maryland. And it goes without saying that this hearing has been called at the request of our good friend from the Eastern Shore, Mr. Gilchrest, who is I know very concerned about this issue.

By way of background, nutria are large semi-aquatic rodents that are native to South America. They have brown fur with small ears. Very good.

[Laughter.]

Webbed hind feet, and a long, lengthy tail. They cannot be called little rats because they are big rats, it says here. The nutria may weigh up to 20 pounds. Nutria live along the banks and lakes, marshes, ponds and rivers. They are surface feeding herbivores that can be extremely destructive to marsh vegetation. These powerful animals forage directly on the vegetative root mat leaving the marsh pitted and digging sites and fragmented with deep swim canals. In the face of rising sea levels, nutria damage is particularly problematic because it accelerates the erosion and the processes associated with tidal currents and wave action.

Nutria were introduced in Maryland in the 1950's to assist the fur industry. There are currently between 100,000 and 150,000 nutria living in the Blackwater National Wildlife Refuge and private fur trappers have not begun to keep pace with the animal's ability to reproduce. To compound this problem there are no natural pred-

ators to control nutria and nutria are causing serious problems for native wildlife, fish, plants and marsh ecosystems.

During the past year, the U.S. Fish and Wildlife Service has been working with the Maryland Department of Natural Resources, the Maryland Cooperative Fish and Wildlife Research Unit, and the Patuxent Wildlife Research Center, the University of Maryland and Tudor Farms on a strategy to deal with the growing problem. This group issued a report on April 3, 1998, entitled "Marsh Restoration: Nutria Control in Maryland".

I look forward to hearing from our witnesses about this report and how or if, its recommendations can be implemented. Thank you all for being here today. I would now like to recognize Mr. Gilchrest for any statement he may have.

[The prepared statement of Mr. Saxton follows:]

STATEMENT OF HON. JIM SAXTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

The Subcommittee will come to order. The Subcommittee on Fisheries Conservation, Wildlife and Oceans is meeting today to conduct an oversight hearing on a pilot program to control the nonindigenous species nutria, which is destroying valuable wetlands at the Blackwater National Wildlife Refuge in Cambridge, Maryland.

By way of background, nutria are large, semi-aquatic rodents that are native to South America. They have brown fur with small ears, webbed hind feet, and a long, lightly haired tail. Wild nutria may weigh up to 20 pounds. Nutria live along the banks of lakes, marshes, ponds, and rivers. They are surface-feeding herbivores that can be extremely destructive to marsh vegetation. These powerful animals forage directly on the vegetative root mat, leaving the marsh pitted with digging sites and fragmented with deep swim canals. In the face of rising sea levels, nutria damage is particularly problematic because it accelerates the erosion and processes associated with tidal currents and wave action.

Nutria were introduced in Maryland in the 1950's to assist the fur industry. There are currently between 100,000 and 150,000 nutria living at the Blackwater National Wildlife Refuge, and private fur trappers have not begun to keep pace with the animals' ability to reproduce. To compound this problem, there are no natural predators to control nutria, and nutria are causing serious problems for native wildlife, fish, plants, and marsh ecosystems.

During the past year, the U.S. Fish and Wildlife Service has been working with the Maryland Department of Natural Resources, the Maryland Cooperative Fish and Wildlife Research Unit, the Patuxent Wildlife Research Center, the University of Maryland, and Tudor Farms on a strategy to deal with the growing nutria problem. This group issued a report on April 3, 1998, entitled "Marsh Restoration: Nutria Control in Maryland."

I look forward to hearing from our witnesses about the report and how, or if, its recommendations can be implemented. Thank you for being here today.

## STATEMENT OF HON. WAYNE T. GILCHREST, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MARYLAND

Mr. GILCHREST. Well, thank you, Mr. Chairman. I appreciate the fact that you've—that you're having this hearing this afternoon. Many of the people in the audience that will discuss this issue today are the constituents of the First District of Maryland. They've been wrestling with this problem for decades if not for years, and we look forward to your testimony and we're up here to try to figure out what we can do to not only resolve the problems of the nutria to bring them into some type of balance, if not eliminate them entirely and appropriate the—or authorize, because we're not the appropriators although that would be an interesting change in next year's rules, the authorizing committees could also be the appropriators. We'd solve a lot of controversy on that, not

only to figure out what to do about the nutria, and I think we as human beings are smart enough to figure out how to reduce their numbers and actually eliminate their numbers. We've done it to a lot of other species so we could probably do it to the nutria or ship them all back to South America.

But in the process I think what we'd like to get out of this project as well in collaboration with Louisiana and other States that are doing the same kind of thing, is an understanding of the complexity of natural processes and how over just the length of time that the planet Earth first came into being to now, the interaction of the complexity of the mechanics of creation are rather extraordinary. That if you pick up a piece of dirt—you go almost anywhere and you get a handful of dirt, and the organized structure in the genetic code of that handful of dirt is more complex than all the land mass of all the planets in the solar system. And we're dealing with natural processes and biological systems are the most complex systems in the universe, and it's not something we want to pass off lightly.

So understanding the nature of introducing a non-indigenous species to the United States and other areas and its impact on the natural processes and how they have evolved over many millions of years, going to teach us I think a valuable lesson about biological diversity and not interfering to the extent that it is possible with the mechanics of those biological systems.

And so I'm really looking forward to the testimony of the witnesses here today, for one, I don't see all of you folks as often as I would like to see you because we've been discussing a lot of these issues, whether they're endangered species; whether they're Delmarva fox squirrel; or whether they're the interesting topic with many of the State people on Wetlands; all of us have been involved in these issues for a number of years. So we look forward to not only your testimony but your continued expertise in resolving some of these issues, and thanks again for coming.

I yield back the balance of my time, Mr. Chairman.

Mr. SAXTON. Would you like to introduce the panel of witnesses?

Mr. GILCHREST. Sure, all right. On the first panel is Glenn Carowan. He's the refuge manager down there; that I think, at least on Sunday, you have nutria for your main course.

[Laughter.]

Ms. Sarah Taylor-Rogers, assistant secretary, Maryland Department of Natural Resources. Sarah and I have gone over a lot of issues relating to the Chesapeake Bay, and I think Sarah probably eats there twice a week.

Michael Haramis, Wildlife Biologist, Patuxent Wildlife Research Center—thanks for coming, Mike.

Dr. Andrew Baldwin, assistant professor of Biological Resources Engineering Department, University of Maryland.

We want to welcome all of you here this afternoon and we look forward to your testimony.

And Ms. Dixie Bounds, I didn't—there you are—Assistant Unit Leader, Wildlife Research, Geological Survey, is here with us today. We've done an interesting thing a few years ago in Congress. We put the Biological Services under—what was that called, the biological—we're going to count the biology. National Biological Sur-

vey—thanks—and it's now in the U.S. Geological Survey, along with nutria. Thanks for coming, Ms. Bounds.

Mr. SAXTON. Thank you very much, Mr. Gilchrest. We're going to proceed. We operate here under what we call a 5-minute rule which gives everybody 5 minutes to make an outline of their testimony and of course, your full testimony, written, will be included in the record if you desire. We'll start with Dixie Bounds and move from your right to your left across the table. So Ms. Bounds, if you would like to begin we're ready to hear your testimony.

**STATEMENT OF GLENN CAROWAN, REFUGE MANAGER, BLACKWATER NATIONAL WILDLIFE REFUGE ACCOMPANIED BY DIXIE BOUNDS, ASSISTANT UNIT LEADER, WILDLIFE RESEARCH, MARYLAND COOPERATIVE FISH AND WILDLIFE RESEARCH UNIT**

Mr. CAROWAN. Dixie is going to be accompanying me, sir.

Mr. SAXTON. OK, very good. Thank you. Glenn Carowan.

Mr. CAROWAN. Thank you. Good afternoon, Mr. Chairman and members of the Subcommittee. I am Glenn Carowan and I'm the manager of Blackwater National Wildlife Refuge on Maryland's Eastern Shore. Accompanying me is Dr. Bounds, the Assistant Unit Leader for Wildlife with the Maryland Cooperative Fish and Wildlife Research Unit.

During my 28 years of managing wetlands for the National Wildlife Refuge System, I've never witnessed marsh loss anywhere as significant as it is occurring now on the lower Eastern Shore. My colleagues and I are very concerned about the health of our marshlands and the impacts that nutria are having on our wetlands in Maryland and throughout our country.

Before you is an average size nutria. These highly invasive, nonnative rodents were introduced from South America to the United States in the early 1900's to stimulate the fur industry. When fur businesses failed in the 1940's nutria were released into the wild. In Louisiana the population quickly grew from 13 in 1937 to an astounding 20 million by the late 1950's. From release sites on or around Blackwater Refuge, refuge populations have grown from 30 released animals in the early 1950's to estimates as high as between 50 and 100,000 today. This is the story for almost half the States and many other refuges in this country as seen on the map. Nutria are established in 22 States and Ontario, with sightings in 40 States and three Canadian provinces.

Nutria devour our wetlands. They consume the above-ground vegetation, excavate the root mat, eliminate plant reproduction, and create large crater-like depressions and deep swim canals that allow saltwater to enter and degrade these delicate ecosystems. The result is that thousands of acres of our Nation's valuable marshlands are degraded or converted to open water. No place on Maryland's Eastern Shore is this more evident than in and around the marshes of Blackwater Refuge, as seen on the comparable aerial photographs that are in front of you.

Over 7,000 acres of marshland have been lost during the 50 years since nutria were first released into the wild. While other factors including sea level rise, land subsidence and salinity changes also affect marsh loss, we recognize that we can only con-

trol nutria populations. Therefore, any effective plans for preserving and restoring our marshlands has to include efforts aimed at eradicating nutria. But with the rate of marsh loss accelerating we must move quickly. Accordingly, 17 Federal, State, and private organizations have joined forces to develop a plan to determine the feasibility of eradicating nutria.

The initial phase of this effort entitled "Marsh Restoration: Nutria Control in Maryland" is based on 5 years of collaboration among the partners with input from private land owners and specialists, and specifically on recommendations by Dr. Morris Gosling, a nutria expert from England. We feel that this pilot program is most applicable to Maryland because of the strength of this multi-agency private partnership that contributes over $1 million in in-kind services, because the nutria population is geographically isolated on the lower Eastern Shore, and because the overall Statewide population is still relatively small when compared to other States.

The National Wildlife Refuge System exists for the protection and management of plants and animals native to the United States. The policy of the Fish and Wildlife Service is to prevent further introduction of exotic species on national wildlife refuges, and to protect those resources from competing with non-native species such as nutria.

Control procedures are delegated to the Secretary of Interior by Executive Order 11987, which also directs Federal agencies to restrict the introduction of exotic species into areas they administer.

Therefore, in addition to being extremely important to the future of Blackwater Refuge, the pilot program also helps other affected refuges achieve the mission for which the National Wildlife Refuge System was established and the purposes for which Congress established these individual units. If successful the program will likewise be helpful to State and private managed areas throughout this country and the world. The adverse effect of nutria foraging and burrowing on our forested and emergent wetlands, our agricultural areas and levees, seriously compromise our ability to achieve our wildlife management objectives and have long-lasting adverse environmental, cultural and economical consequences.

Therefore, we believe that this pilot effort is extremely important to the future welfare of the trust resources which the Fish and Wildlife Service manages for the benefit of the American people.

Thank you for this opportunity to appear before you today and I'll be happy to answer any questions.

[The prepared statement of Mr. Carowan may be found at end of hearing.]

Mr. SAXTON. Thank you very much.

We'll move right along then to the next witness, Mr. Haramis.

**STATEMENT OF MICHAEL HARAMIS, WILDLIFE BIOLOGIST, PATUXENT WILDLIFE RESEARCH CENTER**

Mr. HARAMIS. Mr. Chairman, members of the Subcommittee, it is with pleasure that I appear before you today to provide information relevant to the nutria/marsh loss issue in Maryland. Thank you for inviting me.

My name is Michael Haramis and I'm a research wildlife biologist with the Patuxent Wildlife Research Center, part of the U.S. Geological Survey.

In 1995 I was asked by the State of Maryland Department of Natural Resources and the Fish and Wildlife Service's Blackwater National Wildlife Refuge to conduct a study to investigate the role of non-native nutria on the extensive loss of marsh that has occurred over a number of decades along the Blackwater River and adjoining tidal river marshes in Dorchester County, Maryland. Specifically, since the 1950s, about six square miles of vegetation have been converted to open water on the refuge and over 50 percent of remaining vegetation has been termed unhealthy and likely to be lost in the near future. The result of this habitat change has been to create a large lake out of what was once nearly continuous marshland. You can refer to the black-and-white aerial photos on display that depict this very clearly.

Managers were blaming this loss of marsh on the South American nutria, a large 8–18-pound invasive, beaver-like rodent that was introduced to Maryland's Eastern Shore marshes in the 1940s. The interest in this animal was its potential fur value. No other grazing rodent of this size has ever occupied these habitats in the developmental period of these marshes since the Chesapeake Bay was formed some 10,000 years ago. Nutria are plant eaters that graze surface marsh vegetation and are particularly fond of Olney bulrush, a plant that grows in extensive stands at Blackwater.

To better understand the role of nutria and marsh loss at Blackwater, I designed the largest exclosure study of its kind to address this issue. Over 1.5 miles of fencing were entrenched in the marsh to exclude nutria from 20 experimental plots, each a quarter acre in size. These exclosures would allow us to measure the ability of marsh plants to recover in the absence of nutria grazing and compare it to the plant loss or gain outside the exclosures where nutria were still present. As you can imagine, installing this fencing required several months of intense labor.

To demonstrate the maximum effect of exclosure, I direct your attention to the poster exhibit on your left. The plot on the left half of the photo is one of the first plots fenced and the plants show a remarkable recovery in one growing season after fencing. However, our original fencing technique was not strong enough to keep out the nutria and after 1 year they breached the fence and caused extensive damage to the vegetation on the right. These photographs clearly depict the compelling nature of the devastation that nutria have on marsh vegetation in this area.

One could ask why vegetation didn't recover as rapidly in every exclosure in the absence of nutria? The answer lies in the type and extent of damage that has been inflicted in the marsh. Nutria not only graze the above ground stems of plants, they are powerful animals that dig into the marsh and excavate the root systems which makes plant recovery extremely difficult and in many instances unlikely. This damage to the root mat of vegetation is especially critical because much of the marsh in the Blackwater Basin is floating on a layer of fluid mud, and the root mat is the fabric that holds the marsh together. Once the nutria cut through the root mat, the underlying mud is easily eroded away by water action. The result

is that the marsh breaks up, sinks, and the vegetation is killed by inundation.

I found nutria abundant in this marsh and can report severe damage in much of the marsh that could only likely occur during periods of overpopulation of these animals. Although lightly damaged marsh such as depicted in the above poster has good probability of recovery after nutria are removed, heavily damaged marsh has little recovery potential without some restoration effort.

Although my study will not be completed until 1999, evidence and observations made so far lead me to offer the following conclusions: (1) nutria play a direct role, may have initiated, and I can state with certainty have accelerated the loss of marsh in the Blackwater Basin region; (2) nutria are destructive to this marsh because they have the ability to excavate the root mat, fragment the marsh surface and expose the subsurface to water erosion; (3) nutria are abundant and frequently overpopulated in the marsh. Traditional harvest methods clearly have proven inadequate to control their numbers. And last (4), controlling or eliminating nutria would clearly be beneficial in mediating marsh loss in the Blackwater River Basin.

This ends my presentation. Again, I would like to thank you for this opportunity. I'd be glad to answer any questions you may have.

[The prepared statement of Mr. Haramis may be found at end of hearing.]

Mr. SAXTON. Thank you very much, sir.

Dr. Taylor-Rogers of the Maryland Department of Natural Resources. Welcome.

**STATEMENT OF SARAH TAYLOR-ROGERS, ASSISTANT SECRETARY, MARYLAND DEPARTMENT OF NATURAL RESOURCES ACCOMPANIED BY ROBERT C. COLONA, MARYLAND DEPARTMENT OF NATURAL RESOURCES**

Dr. TAYLOR-ROGERS. Indeed so, sir. Thank you kindly, Mr. Chairman and Congressman Gilchrest. My name is Dr. Sarah Taylor-Rogers. I am an assistant secretary for resources management in the Maryland Department of Natural Resources. I appreciate the opportunity to share with you Maryland's perspective on nutria and also some aspects of the pilot plan that's been developed.

We are concerned about nutria because there is no natural predator for the control of the population and the population is growing. In addition to that, besides the destruction of native habitat, we will be losing that native habitat to the destruction of those very natural resources that use it, such as the fish and shell fish which spawn in these nursery areas. And the Blackwater is part of the Atlantic flyway. To date, eight counties have established populations. Maryland is the best place for this pilot study because the land available on which the nutria happen to be found are primarily Federal and State, so therefore, there is accessibility. The States of Virginia, Maryland, Pennsylvania, and the District of Columbia, along with the Federal partners, have supported a no net loss wetland policy and have fostered species diversity under the Bay Program.

The Department of Natural Resources is also a trust resource partner with the U.S. Fish and Wildlife Service and, as such, is responsible for managing and protecting native natural resources to the best of our ability. And for the last 9 years the State has formed partnerships to assess the nutria problem and its effect on marshland.

These studies are as follows: In 1989 we began a catch per unit effort to assess population characteristics; in 1993 we developed the first multi-agency nutria task force to find ways to control nutria and passed Senate bill 27 which provides for 50 percent of the duck stamp revenues to go toward the control of nutria. In 1994 we contracted with Dr. Gosling from England who had successfully eradicated from East Anglia, and in essence, he told the task force that the same thing could be done in Maryland but to do so we had to do several things.

First, we had to garner information; we had to carry out the exclosure studies which Mike Haramis just described for you; we had to develop a well-structured approach; develop a nutria removal scheme through the use of trappers to assess population and to figure out what it would take to eradicate these 30 pound rats.

The third thing, to assess progress. To set up a monitoring team to assess progress and assess the effect on wetlands and their ability to rebound—and Alan Baldwin will talk about that—and to educate the public through the use of valuable videos and kits, information kits, to inform them that this particular species is nonnative.

Aspects of the plan which are before you and in your packet include the following: We propose the 3 year effort totaling $3.7 million.

Two, of that total amount slightly over $902,000 is being offered in kind by the State, U.S. Fish and Wildlife Service, U.S. Geological Survey, University of Maryland, Ducks Unlimited, and Tour de France.

No. 3, we propose to use three areas for the pilot program located within and outside the Blackwater National Wildlife Sanctuary boundaries. Two of the sites will undergo intensive trappings with humane measures being taken and one area will be the control.

No. 4, we anticipate that an advisory team will be formed comprised of the Federal, State and private partners and that this team will provide advice and guidance to assure success.

No. 5, the trappers and the researchers will together assess the range, health and dynamics of the nutria population as well as the effect on the marsh, and this will garner the information needed. We will do so through the use of radio collars, ear tags, and various trapping techniques will be compared. And also a reward will be established for the return of marked animals.

No. 6, the effect of nutria foraging on marsh vegetation will be assessed and a method will be explored to restore areas of marsh which have experienced the eat-out effect of nutria.

And finally, a public awareness and education campaign is also proposed with exhibits, tool kits and videos being the means for getting the word out. Dr. Gosling noted that the key to successfully removing nutria is to conduct the pilot study that will help the managers and researchers to modify harvest techniques and refine

strategies. The pilot plan for which we are seeking funding from either unspent Federal moneys or new dollars, represent the best thinking and practical approach toward the resolution of this problem.

Thank you very much for the opportunity to present Maryland's perspective. I look forward to any questions.

[The prepared statement of Dr. Taylor-Rogers may be found at end of hearing.]

Mr. SAXTON. Thank you very much, Dr. Rogers.

Dr. Baldwin.

**STATEMENT OF ANDREW BALDWIN, ASSISTANT PROFESSOR, BIOLOGICAL RESOURCES ENGINEERING DEPARTMENT, UNIVERSITY OF MARYLAND**

Dr. BALDWIN. Good afternoon, Mr. Chairman, members of the Subcommittee. My name is Andy Baldwin. I'm with the Department of Biological Resources Engineering at the University of Maryland at College Park. I'm a wetland biologist there. I'm going to be talking today about the wetland restoration demonstration project which is a component of this pilot program to eliminate nutria.

The objectives of this wetland restoration demonstration are first of all to demonstrate that nutria eradication will enhance efforts to restore coastal wetlands. Second, we want to investigate the effects of increases in marsh elevation and planting of native species on the success of restoration efforts. Finally, this information will be used to support the design and implementation of large-scale restoration programs for coastal marshes that are experiencing nutria grazing as well as coastal submergence.

What are some of the factors that control marsh deterioration? Well, you've heard about nutria; these animals cause damage to leaves and roots of marsh plants and they remove the resources of the plants for growth. There's another factor, coastal submergence, and this is the increase in water level relative to the marsh as a result of land subsidence, that is, the sinking of land as well as sea level rise. Higher submergence reduces the ability of plants to grow and inhibits seed germination, preventing colonization of marsh habitat. The combination of nutria grazing and submergence can actually kill wetland vegetation rapidly and this can lead to wetland loss.

How do you restore wetlands? Well, nutria eradication is certainly one component of this. Other important components may be increasing the elevation of marsh sediments somehow to reduce submergence, promoting plant growth and colonization. Another technique is to plant vegetation which should speed the reestablishment of desirable native plant communities and reduce colonization by non-native or invasive species like Phragmites, the giant reed.

One way of restoring or increasing marsh sediment elevation is to use a technique called thin layer sediment deposition. This is a technique where sediment is pumped out of a canal or a channel and pumped through a sprayer so it's deposited on a marsh surface in a very thin layer. This has several advantages over traditional or conventional dredging techniques.

First of all, you can operate this dredging system in a few feet of water such as you have out at Blackwater and other deteriorating areas. You can pump the sediment a long way away from the dredge unit. You can spray it onto both vegetated and non-vegetated areas and this technique has been used successfully down in Louisiana to restore coastal marshes there. What we are proposing to do is to establish two acre areas at both Tudor Farms properties and Blackwater National Wildlife Refuge and subject them to different amounts of sediments, sprayed on using this thin layer deposition technique. In each of these areas we will plant half and leave half unplanted, plant it with a native desirable marsh species such as three Olney's square, and then within that, fence a portion of that area and leave another portion unfenced. That way we could look at interactions among all these factors and how these different treatments, these restoration treatments, affected the success of restoration.

What do we think this will—what kind of benefits will this provide? Well, first of all, it should provide a visual and scientific demonstration of the effects of nutria eradication as well as sediment elevation and vegetation planting on the success of restoration efforts. These findings should be directly applicable to designing and implementing large-scale wetland restoration projects in the mid-Atlantic region and elsewhere in coastal marshes experiencing wetland loss. And finally, this project will have the substantive benefit of creating several acres, restoring several acres of deteriorated coastal marsh.

Thank you very much and I'll take any questions that you may have.

[The prepared statement of Dr. Baldwin may be found at end of hearing.]

Mr. SAXTON. Thank you all very much. I just have a couple of questions. I guess the answers to these questions seems to be self-evident, but let me ask them anyway for the record.

Obviously, as has already been stated, there are no natural enemies for these critters, is that correct? At least in Maryland? Are there natural enemies in other parts of the world, South America?

Dr. BALDWIN. Down in Louisiana there are alligators that eat some of the nutria. Nutria are a real problem down there but there aren't enough alligators to diminish the population to any great extent.

Mr. SAXTON. And it would be a bad idea to import alligators?

[Laughter.]

Dr. BALDWIN. It could be. Another exotic species.

Mr. SAXTON. These critters live obviously above water level in some fashion. How do they change the habitat other than eradicating vegetation and the roots of the vegetation? What kind of houses do they live in? Are they like beaver or muskrats or——

Mr. CAROWAN. They generally live on the surface of the marsh. In Maryland they tend to build leaf nests right on the surface of the marsh. They also burrow into our levees and our dike systems. Particularly in Louisiana we have a large problem with nutria burrowing into the levees around New Orleans and other places. We call them vagabonds. They tend to move around a lot on the sur-

face of the marsh. They don't really build a lodge as such like a beaver would or as a muskrat would.

So they tend to move around and they live pretty much where they can find a spot. If they find a dry spot underneath a tree they'll bed under there. They'll get underneath your building, and they'll get under your front porch. Wherever they can find a place to get out of the weather, that's what they do.

Mr. SAXTON. I see. And the damage they do appears to be quite similar to the damage done by snow geese in some of our central flyway marshes and East Coast flyway—East flyway marshes. Is it the same kind of thing?

Mr. CAROWAN. Very similar. Very, very similar with the exception that nutria tend to excavate much deeper than the snow geese do. That's been my personal experience on Blackwater. They tend to dig that root system up and destroy the vegetation so that it does not come back. Once they dig that root system up we just do not get very much reproduction, recolonization of those areas that have been destroyed.

Mr. SAXTON. And one of the things that Mr. Gilchrest and I have noted over the years is that if it's possible—let me put it another way. Oftentimes we are successful in creating markets for various types of critters—I'm thinking mostly of fish, I guess—and then the supply of fish diminishes in direct correlation to the demand that has been created. Is it possible to create any kind of a demand for fur or meat or any—is there any variation thereof that is a feasible, partial answer?

Dr. TAYLOR-ROGERS. We have been following Louisiana with respect to meat as a delicacy, and also, I think, nutrias trapped for fur. But the problem is that this is an exotic specie that does not have a very strong market at all and the fur market is a very weak one. Most of the exporting of these pelts would go to those very countries that are having difficulty economically.

With your indulgence, I could call in Dr. Robert Colona, who knows a bit more about this if you wish to go into further depth with the question you've asked.

But we've assessed it from the State of Maryland and it just simply isn't practical at all and it would not create a market for us.

Mr. SAXTON. Then the answer is taking the nutria population out via some form of trapping. Is that——

Dr. TAYLOR-ROGERS. That is correct.

Mr. SAXTON. Is that correct? What kind of traps would be used?

Dr. TAYLOR-ROGERS. I would have to defer to Dr. Colona on that one, if I might, please.

Mr. SAXTON. Why don't you come over, so the recorder can hear you, if you don't mind?

Dr. COLONA. The pilot project is designed to investigate all the commonly used traps out there now, from foothold traps; instant kill traps; caged traps; blow traps. Each one of those will be evaluated for efficiency, impacts on non-target species, and general control characteristics. At this point in time we don't know. That's one thing we have to investigate. We don't know what the most efficient technique is.

Mr. SAXTON. Does hunting hold any possibilities?

Dr. COLONA. Under very specific circumstances you can harvest a lot of them in a very short period of time. But those circumstances only occur sporadically throughout the year so you can't base any eradication efforts solely on hunting. It's got to be a marriage of a lot of different techniques.

Mr. SAXTON. Are these nocturnal animals or are they around during the daytime or both?

Dr. COLONA. They're more dependent on the tides than they are on day or night. You can find them out during the day, you can find them out at night. In the winter time when it's very cold you tend to find them out during the day. They're laying out sunning themselves.

Mr. SAXTON. Adaptable little devils, aren't they?

Dr. COLONA. Very much so. They're like furred cockroaches.

Mr. SAXTON. This guy seems to be very well behaved, by the way.

Let me turn to Mr. Gilchrest at this point. I guess, I want to ask you all and I guess Mr. Gilchrest will do this—it will be interesting for me to know at least how we can be helpful because this is obviously a very significant problem. Mr. Gilchrest.

Mr. GILCHREST. Thank you, Mr. Chairman. I just have a few questions. You mentioned they were in eight counties. Are those eight counties on the Eastern Shore?

Dr. TAYLOR-ROGERS. A number of them are on the Eastern Shore, that is indeed correct, but we've also seen some evidence on the Western Shore as well.

Mr. GILCHREST. Where would that be on the Western Shore?

Dr. TAYLOR-ROGERS. In the Patuxent, to my knowledge, and there may be other areas that are not coming to mind right now. And Potomac.

Mr. CAROWAN. Both the Patuxent and the Potomac.

Mr. GILCHREST. Patuxent River and the Potomac River?

Mr. CAROWAN. And the Potomac River.

Mr. GILCHREST. So on the Eastern Shore are they north of Dorchester? Could they be as high as Kent County?

Dr. COLONA. We have established populations from Kent Island South to the Virginia line.

Mr. GILCHREST. Because I think I've seen one at Turner's Creek but I'll have to look a little more close. It wasn't a beaver; sure wasn't a possum. Do they have a—do they have a very narrow range of habitat or are they more like an opportunistic type of creature where they could live outside of—Kent County is not like Dorchester County in the extent of its marsh or wetlands, so could they adapt to an area on Kent County?

Dr. COLONA. We found that they possess more latitude in their habitat or they're able to utilize a larger latitude of habitats than initially thought. Typically, they were thought of as a brackish-water estuarian species, but now we find them up into our freshwater systems; they're in wet forested areas, and we also have them coming up now into some of our croplands. We get crop damage complaint.

Mr. GILCHREST. Is the habitat here giving this range, similar to where they came from in South America?

Dr. COLONA. There's some overlap but it isn't identical.

Mr. GILCHREST. Where did they come from? Which country?

Dr. COLONA. A couple of different countries in South America: Venezuela, Bolivia, Argentina.

Mr. GILCHREST. But their habitat down there was similar to——

Dr. COLONA. Yes, it's a similar wetland ecosystem. There's some overlap, ours varies a little bit.

Mr. GILCHREST. What was—can you identify the difference between what Maryland is going to do or wants to do with what the program has been for some time in Louisiana?

Mr. CAROWAN. I'm sorry, sir.

Mr. GILCHREST. The program, they have a program in Louisiana, apparently for some time partially funded by the Federal Government, State government, so on, dealing with nutria. This program that we're looking to begin here, how is it similar or different from what they've already been doing in Louisiana?

Mr. CAROWAN. My information is fairly limited about Louisiana but what I understand there is the funding that Louisiana has received they're putting directly into means to deal with the fur industry as well as to explore other uses of nutria. This program is entirely different than that and what we're looking at is trying to take this opportunity while these animals are somewhat isolated to the Eastern Shore and the population is still small in regards, in comparison to the Louisiana population, to eradicate these animals.

Mr. GILCHREST. We're looking simply to eliminate them from the landscape completely.

Mr. CAROWAN. We're looking to remove the image of nutria from Maryland.

Mr. GILCHREST. Why, why is it—yes, ma'am?

Dr. BOUNDS. I'd just like to add a little bit to what Glenn Carowan said. We have talked with biologists in Louisiana and they are trying to exploit the restaurant market, trying to make nutria an exotic table cuisine. We've talked about that in our task force and we don't think that would go over very well in Maryland for a couple of reasons.

First of all, there's a strong seafood industry and most folks who visit and vacation on the Eastern Shore want to eat seafood and not a rat.

And second, I've lived on the shore for a long time and I've found that most local folks don't even want to eat the native muskrat. So there's not much chance the locals would eat nutria.

Mr. GILCHREST. But you don't think you could make nutria taste like a crab cake?

[Laughter.]

Dr. BOUNDS. I haven't found that recipe yet.

Mr. GILCHREST. We can make catfish taste like crab cake but I guess that would really be a stretch.

Dr. BOUNDS. One other point about Louisiana is that they're not trying to completely eradicate nutria. Louisiana is atempting to control nutria, and we are hoping to eradicate nutria.

Mr. GILCHREST. I see. Is there a reason the population has remained? Is it because of the geographic location or the population in Maryland has remained relatively small compared to the population in Louisiana?

Mr. CAROWAN. Probably the No. 1 thing that we tend to see is that these animals are all in the northern part of the range on the

Atlantic seaboard and the cold weather does have a tremendous impact on nutria because they are a South American species.

Mr. GILCHREST. So the map up here, those States in the red have nutria?

Mr. CAROWAN. The States in the red have nutria, and as you'll see up there, we also have nutria up as high as Michigan, but I'm not sure under what circumstances or when those were reported. One of the things that we're trying to do now through the co-op unit is to readdress that with every State that's on that map and also with all the refuges that are represented within those States, to get a better handle on just how serious the problem is. The map means there are nutria in Michigan, not necessarily that they have a major problem.

Mr. GILCHREST. Are they in Michigan or Oregon or Washington or Idaho because they were brought in to expand the trapped in species or——

Mr. CAROWAN. That's my understanding. Yes, sir.

Mr. GILCHREST. Along around the same period of time?

Mr. CAROWAN. Yes, sir. Actually, between 1899 and the early 1940's is when nutria were brought into just about all those States.

Mr. GILCHREST. I see. I just have a couple more questions, Mr. Chairman. I see you turned the lights off.

How many acres of marshland—Dr. Baldwin, you mentioned the restoration project for wetlands and something they'll have to get over up here is creating another beach replenishment project. I know this is not beach replenishment, but if we're looking at a long—we look at—and I understand the problems of the nutria and the tidal marsh and the wetlands destruction. But also there is land subsidence and sea-level rise. If you take the nutria out of the picture, which I hope we can do in the next few years. But then you can't take out land subsidence and you can't take out sea-level rise, would it be prudent to continue to pursue the restoration of the marsh which might be eliminated down the road anyway.

Dr. BALDWIN. Well, that's right, you can't control sea-level rise or land subsidence directly but there are techniques where you can increase or help the marsh keep pace with sea-level rise and one of these is to put in additional sediment. Down in Louisiana they're doing things like using this thin layer deposition technique I talked about, and also diverting the Mississippi River into some areas to get more sediment in there so the marshes can keep pace with sea-level rise.

I personally think it's important—I mean you're right, this is something that's going to be, sea-level's going up. But I think it's important to maintain this habitat as much as we can, especially if we need to dredge canals and we need to dispose of this material somehow, let's put it to some good use and create a marsh.

Mr. GILCHREST. I would agree there is a problem all over the country, especially in Maryland where you put the dredge material and if it can be of some beneficial use all the better. There is though, in certain areas of Maryland, when you put the dredge material on the land, especially upland, the chemical make-up of the dredge material or the sediment under water is different than when you transfer it up into the open air, and then it can become a problem with releasing certain, you know, whatever acidic mate-

rials, certain heavy materials that would have to be—how would you deal with that?

Dr. BALDWIN. That's exactly right. When soils are flooded the iron in it is in a reduced state because there's no oxygen. You take it out and you dry it out the iron becomes oxidized, essentially rusts, and that can lead to the formation, especially in saline soils where there's a sulphate source like saltwater soils, can actually form sulfuric acid. In a wetland, a salt marsh, the soil is saturated enough that they're still reducing and so iron is still in a reduced form in a wetland. So if you create a wetland that is still saturated soil, you're not going to have a problem with any sulfur being oxidized.

Mr. GILCHREST. So as long as it's in these wetlands that leaching——

Dr. BALDWIN. That's not going to be a problem because they'll still be reduced. Now if you created a pile that was dry, say a few feet out of the water, that's exactly right and that's what can happen with conventional dredging when you make big piles of dredge spoil, you have that same reaction going on.

Mr. GILCHREST. Do you have an estimate as to the number of acres at least in Blackwater that would have to be restored right now?

Dr. BALDWIN. I'm not sure but if you look at those two maps, what was there I guess in 1938 on the left and then that big open area. A lot of that open area is very shallow water and so it only needs a little bit of sediment but it needs some sediment. In this program we're, through this experimental approach, hoping to restore a maximum of 30 acres, it would probably be somewhere around 15 to 20 acres that would actually get restored.

Mr. GILCHREST. So as part of this whole nutria elimination program, is the restoration of about 30 acres of wetland?

Dr. BALDWIN. That's for the pilot program, yes.

Mr. GILCHREST. And the pilot program would cost—this whole pilot program, is there an estimate to the cost?

Dr. TAYLOR-ROGERS. This particular portion of it or the whole thing?

Mr. GILCHREST. I guess the whole thing. How many—do you have an estimate as to the number of years it's going to take to eliminate nutria and are those number of years a part of the—I guess, the pilot project then is going to take how long to figure out what to do I suppose and then what's the estimated cost?

Dr. BOUNDS. The pilot program is scheduled for 3 years and during that time we hope to look at the feasibility of complete eradication of nutria and marsh restoration. And we would like to point out that by simply removing nutria you are slow down marsh degradation. However, to bring back those areas that have suffered from severe nutria eat-out, we think we do need to go ahead with wetland restoration, that's why we've included the demonstration project.

Mike Haramis has found on his exclosure study that some of the vegetation comes back, as you see in the poster, but in areas that have been severely overgrazed, you have to do something more aggressive than just remove the nutria. You have to also add back

some soil to raise the elevation of the marsh so that the plants can come back.

And to answer your question, the total cost for the 3 year pilot would be $2.9 million. We also have contributions of almost $1 million from the 17 partners. So the total effort would be about $4 million.

Mr. GILCHREST. But you're looking for about 2-something from the Federal Government?

Dr. BOUNDS. Two point nine million.

Mr. GILCHREST. I see. Is there anybody, any other State—has any other State had an elimination program?

Dr. BOUNDS. We are conducting a survey of all 50 States and focusing on all the State agencies for natural resources and the national wildlife refuges within the States shown in red on this map, to find out how they're managing nutria. To our knowledge, at this time, there are no other plans in States to eradicate nutria.

Mr. GILCHREST. What will be done with the trapped nutria? I mean I understand in past years you've trapped or killed up to 10,000 of these little critters. Is there a specific policy as to what you're going to do with these trapped nutria in this program?

Dr. COLONA. A large portion of the animals will be necropsied and used to obtain data to further this research. Now we'll be——

Mr. GILCHREST. They'll be, they'll be what?

Dr. COLONA. They'll be necropsied. We'll look at reproductive tract——

Mr. GILCHREST. What was that word? I want to learn this word.

Dr. COLONA. OK. On humans it's autopsy; on animals it's necropsy.

Mr. GILCHREST. Necropsy?

Dr. COLONA. Yes. We will necropsy the animals, look at reproductive tracts——

Mr. GILCHREST. So you have a thousand, 10,000; you're going to necropsy how many of that?

Dr. COLONA. A representative sample, a large sample. The rest of them will be——

Mr. GILCHREST. So what will the—I mean, so you get—I'm just curious now because I have a question. You get 10,000; you necropsy 100?

Dr. COLONA. You can necropsy 10 percent.

Mr. GILCHREST. Ten percent, you necropsy 1,000; you've got 9,000 of these things. Seriously, can they be processed at a local processing plant and then sent to Joseph's House in Salisbury or some other place? If it's meat and it's edible, can it be distributed in that manner?

Dr. BALDWIN. I think it could be. I actually have had the opportunity to eat nutria down in Louisiana and I enjoyed it.

Mr. GILCHREST. Can you tell us what it tastes like?

Dr. BALDWIN. I could say it tastes like chicken, but that's the obvious answer. It's actually a light meat and these animals just eat plants so it's a clean meat, they're running wild, it's very low fat. I know that Paul Prudomme and his sister are trying to come up with a recipe to try and further it. It's not—they have a nutria festival there, but still not big because they call——

Mr. GILCHREST. Dorchester has a nutria festival?

Dr. BALDWIN. No, this is down in Louisiana.

Mr. GILCHREST. Oh, I wondered why I hadn't gone to that.

Dr. BALDWIN. But they serve nutria and that sort of thing. But it's still not even popular down in Louisiana as a food because they still call it swamp rat or nutria. They don't—I think the concoction that Prudomme came up with called "Ragondin etoufée," which sounds a lot better but——

Mr. GILCHREST. I think it would be at least—then I'll close up my questions. The chairman is being very lenient with me.

Sarah, do you have a comment?

Dr. TAYLOR-ROGERS. Might I respond also? We do have a, although albeit it's more plentiful, we have a program where we provide deer, venison, in our hunting program to various areas that could use the meat to help feed the hunger or to help others and I think we could also look into that as well as a State with respect to nutria.

Mr. GILCHREST. I'm sure it might be worth—now I suppose the program only affects Blackwater refuge. No other spot in Maryland?

Mr. CAROWAN. Oh, no, sir. In terms of the pilot program?

Mr. GILCHREST. Yes.

Mr. CAROWAN. No, sir. The pilot program is actually just using the refuge as one of three sites.

Mr. GILCHREST. Oh, I see.

Mr. CAROWAN. We are particularly interested, as you will hear later, also for looking at Tudor Farms, which is a private site, and they have done a lot of work on their own and are a significant contributing partner to this effort. And we're also looking at the State area on Fishing Bay Wildlife Management Area that's managed by Maryland DNR. So we're kind of looking at three different sites throughout Dorchester County.

Mr. GILCHREST. So eventually we're looking to eradicate nutria in the State or, the State of Maryland, that Delmarva Peninsula, this region?

Mr. CAROWAN. That's correct.

Mr. GILCHREST. Often the chairman of the full Committee brings moose meat on the House floor. Maybe Jim and I could bring nutria sometime in the future before the session's over.

[Laughter.]

And it might become possible in Washington. Thank you, Mr. Chairman.

Mr. SAXTON. Let me just ask Dr. Rogers a question. I get the feeling that—not only the feeling—I mean you've carefully stated that the program is an eradication program not a population control program—and then I get the feeling in another court, you know, when we're talking about creating a market for the meat or whatever, that you would rather not, I just get this feeling, you haven't said this, that you would rather not be involved in that because in some ways it runs counter to an eradication program. In other words, if you create a market there's a reason to keep some of these guys around and you don't want to do that. Is that correct?

Dr. TAYLOR-ROGERS. That is correct. I'll be clear in my answer, and the reason why is the resources that so depend upon the Blackwater area for their very life cycle and sustenance, could very

well continue to be endangered if we do not eradicate the nutria from this area. And it is those resources that are native to Maryland and native to the Delmarva Peninsula that are important to try to maintain, protect and manage over a non-native specie.

I hope that is a clarification.

Mr. SAXTON. Yes, ma'am, that's very clear and I think that's very helpful. Now what Mr. Gilchrest, who has been the real leader here in Congress on this issue would like to do is to be helpful as possible and he has drafted legislation that I think you're aware of. Is that correct?

Dr. TAYLOR-ROGERS. I have heard that he has drafted it. I haven't seen it but I have heard he has. Yes.

Mr. SAXTON. OK, well, it's a fairly simple bill that goes to support your program which provides for a Federal share not to exceed 50 percent of the total cost of the program and that the local shares can be in the form of income contributions and will authorize the Appropriations Committee to appropriate whatever the amount of money is that's needed. And that is the approach that you're looking for and that's what you want us to do in a general sense. Is that correct?

Dr. TAYLOR-ROGERS. Yes, we are indeed and you had asked how can the Committee be helpful, that is indeed what we're looking for by way of help. And we will also as a State, be trying to secure some additional supplemental funds to help out with this as well.

Mr. SAXTON. Thank you. I have no further questions at this time and we thank you very much for coming and articulating the issues so eloquently for us and helping me as a non-Marylander to understand. I can only hope that we never have them on the New Jersey Coast. So we'll try to help you get rid of them in Maryland so they don't move further north.

Dr. TAYLOR-ROGERS. Thank you kindly.

Mr. SAXTON. OK, well, thank you and some other members may have some additional questions for you and we may ask you to respond to some in writing so the hearing record will remain open.

Now let me introduce our second panel. On Panel two we have Dr. Edward Soutiere, president and manager of Tudor Farms, Inc.; Mr. Richard Pierce, director of operations for the Great Lakes and Atlantic Region office of DU, one of my favorite organizations; and Mr. James Rapp, director of the Salisbury Zoological Park.

As you gentlemen are taking your places at the table behind your sign let me just reiterate that in the interest of our schedule and time we have allotted each of you 5 minutes for your opening statement and that your entire statement will be included in the record should you desire.

And so, sir, Doctor, you may begin at your leisure.

**STATEMENT OF EDWARD C. SOUTIERE, PRESIDENT AND MANAGER, TUDOR FARMS, INC.**

Dr. SOUTIERE. Thank you, Mr. Chairman. Mr. Chairman, Mr. Gilchrest, my name is Ed Soutiere. I am manager of Tudor Farms. Tudor Farms is a privately owned wildlife management area and hunting preserve located on the Transquaking and Chicamacomico River watersheds upstream of the Blackwater River and Fishing Bay marsh complexes. I manage the farm's 5,500 acres for a vari-

ety of wildlife both upland and wetland species, but managing for waterfowl is our priority.

Our 2,400 acres of tidal marsh and 200 acres of manmade freshwater wetlands are important habitat to thousands of ducks, geese and shorebirds. All the tidal marsh upstream and immediately downstream of Tudor Farms is privately owned, and all of this marshland is either owned by waterfowl hunt clubs, leased to waterfowl hunters by the owners, or hunted on by the owners themselves. Today this Committee is addressing the loss of valuable wetlands at the Blackwater National Wildlife Refuge caused in part by the nutria. I welcome this opportunity to remind the Committee that private owners of wetlands in Dorchester County, Maryland are suffering the same losses and damage and that we too are interested in finding a solution.

In the 9 years that I have managed Tudor Farms, 500 acres of vegetated tidal marsh have converted to mudflats and open water. Marsh loss is greatest, averaging 30 percent to 40 percent in the in the broad marsh expanses adjacent to the Transquaking and Chicamacomico Rivers, and least in the narrow headwater marshes of the creeks feeding into these rivers. Early on my staff and I recognized that nutria were damaging the marsh with their feeding and traveling activities. In addition, nutria feed in our crop fields and landscape plantings, and dig and burrow in our water control dikes and structures causing thousands of dollars of damage annually. I might also add that last year our veterinarian bills for our hunting dogs was $2,000, that is they had confrontations with nutria and it took that much to put them back together again.

Hoping to control, if not reduce, the population of nutria on Tudor Farms, I opened the farm to trapping by several local trappers in 1992. These trappers were of course most interested in trapping muskrat, raccoon and fox for which there is a good, strong fur market. There is no market for the fur of nutria in Maryland, so I gave the trappers the cash incentive of $1.25 for each nutria killed. In 1995 Tudor Farms awarded a research grant to the University of Maryland Eastern Shore to study the nutria on Tudor Farms and to determine what if any effect, the trapping was having on the nutria population. The graduate student, Lara Ras, who conducted the research will complete her program of study at the University of Maryland Eastern Shore this fall and Ms. Ras is also sitting in the audience.

At this time, I can tell you that the number of nutria trapped or shot each trapping season since 1992 has remained relatively stable at about 5,000 per year. The estimates of nutria numbers on Tudor Farms have also remained stable at 17,000 to 24,000, or 7 to 10 nutria per acre of marsh. This means that at best we have succeeded in removing only 25 percent of the nutria population each year. For nutria, which reach sexual maturity at 6 months of age and which can have two or three litters of four or five young per year, this is no control at all.

I have concluded that traditional trapping during the 4-month fur-bearer season in Maryland cannot alone control nutria numbers. Furthermore, the removal of 25 percent of a nutria population each year is insufficient to arrest the loss of vegetated marshland.

Eradication, a much more difficult objective than control, is a desirable goal for Maryland if we are to have any hope of retaining our valuable tidal marshes. But eradication would require the dedicated effort of a professional staff working full-time and year-round for several years and some help from Mother Nature to achieve. Public support for the eradication effort will be essential, for as Dr. Gosling noted during his 1994 seminar at Tudor Farms on the subject of the United Kingdom nutria eradication program, in the eradication program "the only nutria you are paying for is the last one."

Tudor Farms will support the pilot project, "Marsh Restoration: Nutria Control in Maryland" with contributions of cash and in-kind assistance. We have a vested interest in maintaining a healthy wetland system in the Chesapeake Bay. I believe our neighbors share our interest. I urge this Committee to support the funding request for the proposed pilot project. We clearly need to move quickly to find and develop techniques to save and restore our fast vanishing marshlands.

I thank you for the opportunity to speak here today.

[The prepared statement of Mr. Soutiere may be found at end of hearing.]

Mr. SAXTON. Doctor, thank you very much.

Mr. Pierce.

**STATEMENT OF RICHARD B. PIERCE, DIRECTOR OF OPERATIONS FOR DUCKS UNLIMITED, INC.S GREAT LAKES/ATLANTIC REGIONAL OFFICE**

Mr. PIERCE. Good afternoon, Mr. Chairman and Congressman Gilchrest. My name is Richard Pierce, and I am director of operations for Ducks Unlimited Great Lakes and Atlantic Regional Office. My staff and I are responsible for delivering Ducks Unlimited's conservation programs along with the mid-Atlantic coast.

Ducks Unlimited is the largest non-government waterfowl and wetland conservation organization in the world, having more than a million supporters. Since its founding in 1937, Ducks Unlimited has raised more than $1 billion to conserve over eight million acres of critical wildlife habitat in all 50 States, eight Canadian provinces, and key areas in Mexico.

Since 1987, Ducks Unlimited has worked with State, Federal and private conservation partners to restore, protect and enhance over 40,000 acres of wetlands and associated habitat within the Chesapeake Bay watershed. In May 1997, we announced our Chesapeake Bay initiative, a joint partnership with the Chesapeake Bay Foundation and other partners, to restore wildlife habitat on an integrated landscape approach and improve water quality by reducing sediment and nutria loading into the Chesapeake Bay. This initiative is an ambitious effort to restore over 90,000 acres of wildlife habitat and raise some $20 million to support our conservation efforts and the efforts of our State and Federal partners. Through this initiative we have been working with the U.S. Department of Agriculture and Interior to implement conservation programs including the Partners for Wildlife Program, Conservation Reserve

Program, Wetlands Reserve Program, and the Wildlife Habitat Incentive Program.

The tidal marshes of the Chesapeake Bay provides habitat for over 1 million wintering waterfowl which accounts for approximately 35 percent of all waterfowl wintering in the Atlantic Flyway. Species of continental importance including the American Black ducks, Canvasback, Leser and Greater Scaup, and the Atlantic Population of Canada Geese. In addition to waterfowl, the Bay's ecosystem support over 2,700 species of fish and wildlife.

As you have heard from previous testimony, nutria, an introduced exotic species, have caused severe damage to the tidal marshes of the Chesapeake Bay. Due to the dependence of large populations of waterfowl and other wildlife on these affected ecosystem, Ducks Unlimited finds that controlling nutria populations and restoring tidal wetlands is a priority for our Chesapeake Bay initiative. Impacts to tidal marshes are a result of several factors, including sea level rise, land subsidence, erosion and nutria. Nutria are large herbivore that feed directly on the vegetation that provides structure to a marsh. Their impacts result in a change in the vegetative composition of an emergent marsh, and even the total loss of the marsh to open water. In either case the vegetative communities are altered and productive waterfowl and wildlife habitat is lost.

Nutria feeding habitats create a highly erosive conditions and leave the marsh pitted with holes and swim channels and often void of vegetation. The primary food source for nutria is three square bulrush. That same bulrush is also a favorite and valuable food for wintering waterfowl. The loss of this vegetation component leads to a reduction in the vertebrae populations which migratory waterfowl readily depend upon.

Additionally, increased rates of erosion in concert with rising sea levels and the increase in the hydroperiod or flooding regime of the marsh, which limits the ability of three square bulrush and other plants to regenerate a site. The swim channels through the marsh also permit the tidal inundation of many isolated and interior ponds that support submerged aquatic vegetation. The increase in salinity and turbidity limits the growing conditions for submerged aquatic vegetation, and has reduced many interior ponds to barren mud flats. Submerged aquatic vegetation is an important food source for migrating and wintering waterfowl, especially the American Black duck, a species of priority concern in the Atlantic Flyway.

The restoration of tidal wetlands is an important component of our Chesapeake Bay Initiative. Tidal wetland systems are some of the most productive ecosystems in the world, supporting thousands of aquatic and terrestrial species, including many that are threatened and endangered. Maryland has lost over 73 percent of its original wetlands making the remaining wetlands vital to maintain the health of the Bay's ecosystem.

Unfortunately, large expanses of Maryland's remaining marshes have been degraded by nutria. Therefore, Ducks Unlimited supports this plan and its goal of controlling nutria populations and restoring marsh habitat. We also support the plan's efforts to study alternative restoration techniques in order to minimize cost and in-

crease restoration effectiveness once it begins. Controlling nutria is just one step in slowing the rate of marsh loss in Chesapeake Bay. Restoration projects should also be implemented as soon as possible in order to study restoration techniques and to establish demonstration projects that educate the public on the importance of these coastal marshes.

Mr. Chairman, members of this Committee, thank you for your time and attention. I have provided a copy of my written testimony and ask that it be included in the record.

[The prepared statement of Mr. Pierce may be found at end of hearing.]

Mr. SAXTON. Thank you very much, Mr. Pierce. That was very informative and articulate testimony and we appreciate it.

Mr. Rapp.

**STATEMENT OF JIM RAPP, DIRECTOR, SALISBURY ZOOLOGICAL PARK**

Mr. RAPP. Thank you, Mr. Chairman, Congressman Gilchrest. My name is Jim Rapp and I'm director of the Salisbury Zoological Park in Salisbury, Maryland. I've worked for the zoo for 10 years serving in a number of capacities including the zoo's education director.

The Salisbury Zoo has been a member of the American Zoo and Aquarium Association, the AZA, since 1972, and has an annual attendance of about 250,000 visitors including 15,000 local school children.

The Salisbury Zoo appreciates the opportunity to testify before the Committee on the pilot program proposal. The zoo supports this proposal and expects to be an integral partner in carrying out the educational mission of the proposal.

As I am the last speaker today, my comments will focus on the educational impacts of introducing exotic species to our Nation's ecosystems, and the importance of educating the public to prevent further destruction of Maryland wetlands.

Exotic species introductions, whether intentional or unintentional, seem to be an inevitable result of human activities which may result in both economic and ecological problems. It has been estimated that over 90 percent of all such introductions have been harmful in some respect. As U.S. Fish and Wildlife Director Jamie Clark said, "invasive species tend to be very adaptive, aggressive and resilient. Once they are established, we are unlikely to ever completely eradicate them." In fact, Mr. Chairman, this last past Sunday, CNN aired a new segment from their "Earth Matters" program called "Invader Animals" that illustrated the devastating effects of exotic species in the U.S.

The United States has been the unfortunate recipient of exotic species since colonial times but the problem has grown to new heights during this century. In the late 1920's the migration of the sea lamprey into the Great Lakes began its reign of terror on populations of lake trout. Since that time our Nation has been in a constant battle to prevent either the spread of established exotic species or the introduction of new ones. However, one species in particular, the zebra mussel, truly heightened the dangers of exotic species to local ecosystems and what is necessary to prevent fur-

ther damage. The zebra mussel was unintentionally introduced into the Great Lakes during the 1980's through untreated ballast of ships and in less than 10 years it has established itself throughout the Great Lakes to Mississippi River, and many other of our national waterways. The zebra mussel has caused tens of millions of dollars in damage through filtration systems throughout these areas and at the same time has smothered populations of native clams, mussels and other aquatic life.

In addition to zebra mussels, exotic species such as the gypsy moth and pine boring beetle, have caused billions of dollars in damage to our forests, fields and waterways as well as our agriculture and timber industries. Other exotic species affect a number of ecosystems by displacing native species such as the exotic mute swan, the giant reed known Phragmites, and the devastating brown tree snake. The brown tree snake was introduced to Guam in the late 1940's aboard military equipment. The snake has since then spread throughout the formerly snake-free island, eating the majority of Guam's native bird population. The result: there are no more native birds in the wild on Guam and the forest is eerily silent. The brown tree snake's devastation is also felt throughout Micronesia. Two critically endangered species, the Guam Rail and the Micronesian kingfisher are the focus of a breeding program and recovery plan involving the Department of the Interior and 30 institutional members of the American Zoo and Aquarium Association. Hopefully, these two species can be returned to their native island habitat someday.

In an effort to preserve native ecosystems and species that depend on them and to curb the adverse effects of exotic species introductions, biologists have recommended numerous methods of population control and sometimes complete eradication of exotic species.

The State of Maryland, particularly the Eastern Shore of Maryland, finds itself with a serious nutria problem. Mr. Chairman, as the Committee is well aware, the Chesapeake Bay and the wetlands of the Eastern Shore are recognized as some of the most important ecological areas in the United States and have received global recognition as wetlands of international importance under the Ramsar Convention Treaty. Maryland's wetlands are used for fishing, hunting, trapping, berry and timber harvesting, and the growing interest in bird-watching and outdoor photography. The Salisbury Zoo has been an active partner in developing ecotourism on the Eastern Shore to the promotion of the Delmarva Birding Weekend, and the creation of the Delmarva Birding Guide. The Wetlands in this area are home to hundreds of species of animals and plants and serve as important or nursery sites for many thin fish and shell fish. These wetlands are also vitally important to over one million waterfowl that winter in the Chesapeake Bay or use it as part of their migration. Resource managers fear that without intervention the significant ecological, cultural and economic benefits of wetlands in Maryland will be completely lost within the next decade.

While it is important to confront the threats of develop, erosion, and agricultural runoff to Maryland wetlands, dealing with the exotic nutria can be perhaps an easier task. The goal of the Nutria Control Program is to develop methods and strategies to control

nutria populations, restore marsh habitat and promote public understanding of the importance of preserving Maryland's wetlands. The pilot program for control and eventual eradication of nutria will also be extremely beneficial in preventing future species from being added to the Endangered Species Act, especially if the nutria continues its conquest of wetlands habitat in the U.S. The primary mission of the Salisbury Zoo is to increase the public's awareness and appreciation of wildlife and encourage citizens to become active in conservation efforts. The zoo would be a natural partner with Blackwater National Wildlife Refuge and other members of the public education committee, for sharing information about the significance of wetlands restoration and nutria control.

I believe this proposal is a good practical first step in trying to better understand the scope of nutria problem in the Blackwater watershed, and how to best take on this destructive adversary. An ounce of prevention is indeed worth a pound of cure, and weighing the cost of long-term nutria destruction and the cost of this pilot program, I believe the answer is clear.

Thank you for allowing me to testify in support of the proposed pilot program for marsh restoration and nutria control.

[The prepared statement of Mr. Rapp may be found at end of hearing.]

Mr. SAXTON. Thank you very much, Mr. Rapp. I'm particularly pleased that you spoke of other non-indigenous species that have been either introduced intentionally or unintentionally throughout not only our country but some other parts of the world as well. It seems to me that what we're experiencing here can be a lesson that we should take very seriously. So thank you for your testimony.

I would also like to make note that Mr. Greg Linscombe who is the programs manager, Fur and Refuge Division of Louisiana Department of Wildlife and Fisheries is here with us today and has submitted some testimony which I ask unanimous consent be included in the record.

[The prepared statement of Mr. Linscombe may be found at end of hearing.]

Mr. SAXTON. And I think it's noteworthy, this problem, along with being an Eastern Shore problem is obviously a horrendous problem in Louisiana as well. This testimony says in part that the control of nutria in Louisiana is among the top priorities for the State of Louisiana, where over 3.3 million acres of coastal wetlands now exist. Wetland damage in Louisiana attributable to nutria is now conservatively estimated to exceed 80,000 acres in the South East portion of the state.

So this is, indeed, a very serious problem and one that this member and I know, Mr. Gilchrest, take very seriously. We've been chatting here during the last hour or so about how to proceed and I don't know that we have come to any firm conclusion except to say that we are going to put the finishing touches to Mr. Gilchrest's bill or he is and then we will proceed in an expedited fashion to deal with it through this Committee and on the floor of the House.

Mr. Gilchrest, do you have any questions at this time for this panel?

Mr. GILCHREST. Just a few, Mr. Chairman. Thank you.

Dr. Soutiere, it's good to see you again. We haven't seen each other for quite a few years now.

Dr. SOUTIERE. You again, sir.

Mr. GILCHREST. Family doing all right?

Dr. SOUTIERE. They're doing well.

Mr. GILCHREST. I guess the kids are grown up now.

Dr. SOUTIERE. Well, Shawn, we finally got him out of college.

Mr. GILCHREST. You did? I have two still in college but they're about ready to—one more year.

Dr. SOUTIERE. Thank you for asking.

Mr. GILCHREST. Shawn's doing all right?

Dr. SOUTIERE. Yes.

Mr. GILCHREST. That's great. Tell him I said hi. I taught Shawn in high school.

Dr. Soutiere, this nutria population, has it impacted or reduced the population of opossum on Tudor Farms, or raccoons or fox or anything? Have they displaced any of those other animals?

Dr. SOUTIERE. It has not displaced any of the uplands species which you happen to have listed. There's some sense that the muskrat has declined as the nutria numbers have increased. Trappers certainly are not catching as many muskrat on our marshes as they did historically. I can't point that there's any direct antagonism between the two species but certainly they're occupying similar habitats and eating the same kinds of plants. And I would say when nutria eats its dinner muskrat doesn't get a chance to eat it.

Mr. GILCHREST. You said, did you say that there can sometimes be pretty violent conflicts, confrontation between the nutria and hunting dogs?

Dr. SOUTIERE. I have had both staff injured and my dogs have been injured. Dogs of course don't know better and will attack nutria cornered. They're very aggressive. You can see that the long incisors on that mounted nutria in front of you. They cut and slash. They're very capable of defending themselves and I've had one employee who, he boxed in a nutria so I guess in a way you could say he put the animal on the defense, tore right through his hip boots and made a pretty bad gash wound in the upper thigh. They're capable of defending themselves.

Mr. GILCHREST. Are there any beaver down there at Tudor Farms?

Dr. SOUTIERE. There are no beaver on Tudor Farms.

Mr. GILCHREST. You also mentioned, is there a difference between the hide of muskrat, opossum, raccoon, nutria that makes nutria not a very profitable hide to sell?

Dr. SOUTIERE. Very definite differences. Probably the best to compare is with the muskrat and the nutria. The muskrat has a thicker fur, it's finer, denser. The fur of the nutria tends to be quite coarse and has a longer guard hairs and the only good hair, a good portion of the fur tends to be on the belly so if there is any market it's only for a small portion of the actual pelt. In recent years there's been no economic market to speak of for the nutria. The fur industry and the fur market for fur coats has been weak in general.

Mr. GILCHREST. Has there ever been any reports of nutria with rabies?

Dr. SOUTIERE. Not to my knowledge, no.

Mr. GILCHREST. This is a little off the subject but is there a phragmite problem in Tudor Farms?

Dr. SOUTIERE. We don't have a problem per se because we've aggressively attacked phragmites. We spend about $25,000 a year controlling phragmites. I guess you could say that's a problem. But it's certainly not like the Delaware marshes where it's totally taken over. Ours is limited to smaller pockets and we're aggressively going after it.

Mr. GILCHREST. Are you aware of nutria living—I would guess Delaware has a similar problem or at least some problem. Can nutria—and I'm not suggesting this as an alternative——

[Laughter.]

Dr. SOUTIERE. You're about to ask me if we eat phragmites.

Mr. GILCHREST. No, can nutria live in, within phragmites given the difference between that and marsh grass and what Doctor, Mr. Pierce has referred to as——

Dr. SOUTIERE. Square bulrush. Three-square bulrush.

Mr. GILCHREST. Three-square bulrush.

Dr. SOUTIERE. Only three square. Three square. Only three square is the preferred food of both the nutria and the muskrat. Nutria certainly live in phragmites stands but we see very little evidence that they do much grazing on the root tubers of phragmites. Certainly not enough to do any damage to it unlike the damage they do to the three square marshes.

Mr. GILCHREST. We're in a 3-year, I think we're in the third year going into the fourth year of a moratorium on Canada goose hunting based on the population.

Dr. SOUTIERE. On the migratory——

Mr. GILCHREST. On the migratory Canada goose. Have you seen any change in the population of Canada goose in and around Tudor Farms in the last three, 4 years?

Dr. SOUTIERE. I can read that question two ways: The migratory——

Mr. GILCHREST. Totally academic. I just want migratories. I'm not concerned with the——

Dr. SOUTIERE. The migratories, we saw a very nice increase in the numbers of migratory birds during the last fall migration. Now our resident flock of geese are rapidly approaching nuisance numbers.

Mr. GILCHREST. Really?

Dr. SOUTIERE. Yes.

Mr. GILCHREST. Another pilot program. We'll get Duncan Hunter down there, turning the animals. The whole posse.

A couple of other quick questions. Mr. Pierce, what would be—and I know someone mentioned in their testimony that the stamp, part of the money from the stamp program would be contributed to the Nutria Elimination Program. Was I correct when I heard that?

Mr. PIERCE. The comment was from the lady from Maryland and I believe she was referring to the waterhouse stamp issued by the State of Maryland.

Mr. GILCHREST. What would be Ducks Unlimited's contribution to the Nutria Eradication Program?

Mr. PIERCE. Our contributions would primarily be in the restoration field in restoring the marshes and both our technology and expertise here.

Mr. GILCHREST. So then you would work with Dr. Baldwin from the University of Maryland in that program that he described?

Mr. PIERCE. That's correct.

Mr. GILCHREST. How have you restored—you mentioned restoring 40,000 acres of wetlands in the Chesapeake Bay Watershed. Could you give us some idea how that process went? How you restored some of those wetlands? Was it through mitigation system, was it restoring wetlands that had been drained or filled in the past?

Mr. PIERCE. A couple of different approaches. The first approach would be working with private land owners to restore impacted wetlands on their property at their wish and their desire; providing again technical assistance and monetary assistance; helping the natural resources, conservation service deliver those programs throughout the Susquehanna River drainage, through all the States impacted there. And also working on the public-owned marshes with our Federal and State partners to do restoration work on those marshes.

Mr. GILCHREST. Has that been a pretty successful operation? Much resistance? Pretty good working relationship with Federal and State agencies and private land owners?

Mr. PIERCE. Very good, particularly with our partners in the Chesapeake Bay Foundation and the Federal and State partners included so a great number of people are interested in this area and are working very well.

Mr. GILCHREST. I would suppose then you would agree with the total elimination policy of the nutria?

Mr. PIERCE. Absolutely. Absolutely.

Mr. GILCHREST. Have you seen an increase in the laboratory county goose population in the last few years?

Mr. PIERCE. The Atlantic population has recovered, not fully recovered, but has rebounded very well. Last fall we had very good fall flights and we're not going to recommend or we'll not be increasing hunting. But yes, a very good increase and an explosion in the locals and that created confusions amongst people living in the area.

Mr. GILCHREST. So you said your recommendation would be to—now the moratorium was three to 5 years and I think we're going into our fourth year.

Mr. PIERCE. I believe the Fish and Wildlife Service has said they will continue for one more year with it.

Mr. GILCHREST. So do you agree with that assessment?

Mr. PIERCE. We agree with the Fish and Wildlife Service's recommendations.

Mr. GILCHREST. Thank you.

Mr. Rapp, Salisbury Zoo, do you have any live nutria down there?

Mr. RAPP. We have in the past and we've discussed it as part of a South American exhibit but not a native Eastern Shore exhibit. Don't want to give people that impression.

Mr. GILCHREST. So are you going to have a display of nutria?

Mr. RAPP. We discussed it. We're doing a master plan right now for the zoo that we really want to focus. Our collection is based on north and South American wildlife which is fairly interesting as to the nutria problem and we've exhibited them in a South American context before. We'd like to bring them back in, especially with this program being introduced, it would be very beneficial for local school children to see what they look like and create an awareness.

It is a bit of an issue, you know, talking to children about basically eradicating an animal but conservation and ecology is what we talk about in zoos. It goes beyond just an appreciation for living things. Very interested in exhibiting nutria again but just females.

Mr. GILCHREST. You couldn't put a little display next to that, you know, cage where the nutria would reside with a little table there and some kind of a hot sauce, whatever they use. A sample.

Mr. RAPP. A sample table.

Mr. GILCHREST. A sample table.

Mr. RAPP. We sure could. Could be a good fundraiser for us. I don't know.

Mr. GILCHREST. They could come in with a little tooth pick.

Mr. RAPP. On a tooth pick?

Mr. GILCHREST. Do you have any—would you say that the pilot program as you understand it is—I guess you would agree with—would you agree with elimination?

Mr. RAPP. Yes, I would. I go to Blackwater frequently, birdwatching and wildlife viewing. It's a tremendous growing industry in our area and just the effects, as has been demonstrated by most folks up here, of what nutria can do to a marsh would severely destroy a lot of the opportunities we have done there for wildlife viewing and that is, we're beginning that market now.

We've been very pleased with the responses we've had. Not just the zoo and other partners in promoting, not just birdwatching, but canoeing, kayaking and the like and you don't want to canoe through a nutria marsh. What are you going to look at? But you want to go through a healthy—only you see a lot of adversity.

Mr. GILCHREST. What do you see are the Salisbury's Zoo's contribution to this project?

Mr. RAPP. We'd like to develop a program focused toward school children and adults as well, but a program dealing with the subject of introduced species. We do that quite a bit as it is right now. We have a program actually adopted through a National Wildlife Federation Environmental Education Manual called "Invaders in Paradise" that deals with introduced species on Hawaii, and it's actually a play that kids do that takes about 15 minutes.

You start off in the pristine era of Hawaii a couple of hundred years ago, you bring in the rats and the pigs and the goats and all these animals don't belong there. And Hawaii is a great case in point. I believe it's about 50 percent of their birds are endangered right now and they lost 50 percent, extinct. Island species is a little bit more sensitive on occasion than some of our species in the 48 States but nonetheless it's a very serious problem on the island nation as well as on the Eastern Shore, but it really gives kids an idea that this isn't part of what the national system is all about.

You mentioned very well in your earlier statements, about tying in machinery of nature and nutria just don't fit. Not up here they don't.

Mr. GILCHREST. Thank you very much, Mr. Rapp, Mr. Pierce, and Dr. Soutiere. We welcome your input and we'll do what we can on this level to help everybody out down there, Great State of Maryland plus the Eastern Shore. Thank you gentlemen, very much.

Mr. SAXTON. Thank you, Mr. Gilchrest. Let me just pause to discuss one other issue that has been raised here on a couple of occasions and that is the local Canada goose issue. I guess I learned a while back that in as much as this is a sub-species, it wasn't necessarily indigenous to the Eastern part of the country. Is that what you understand, Mr. Pierce?

Mr. PIERCE. That's correct. The giant Canada geese were reintroduced by Fish and Wildlife agencies throughout the upper midwest and the east coast.

Mr. SAXTON. They were indigenous to the upper midwest?

Mr. PIERCE. Yes.

Mr. SAXTON. But not to the east coast?

Mr. PIERCE. Mr. Chairman, I can't answer that. I don't think so but that's a guess.

Mr. SAXTON. In my lifetime I've seen different patterns seemingly exist. One pattern is the one that you've mentioned about the, what do you call them, an epidemic of local geese or something like that. In addition to that, I've always been curious. When I was a young adult, I think we almost had to go to the Eastern Shore if we wanted to see or hunt Canada geese and then over a decade or two all of a sudden I guess determined short stop in New Jersey and Pennsylvania, that seems to me to be a different pattern even with regard to the migratory species. Is that correct?

Mr. PIERCE. The Giant Canadas basically don't migrate.

Mr. SAXTON. The Giant Canadas are what we refer to as local?

Mr. PIERCE. As local, yes, and the migratory birds, their pattern has been impacted by these resident geese who stay there, who attract and hold the migratory birds also by changes in agriculture that's opened up the landscape and made good wintering areas in the upper midwest and in further northern areas with farm ponds and large reservoirs constructed by man and also in part by the refuge systems.

Mr. SAXTON. So the introduction of a non-indigenous species, or what we believe is probably a non-indigenous species, the Giants, had an effect on the life patterns of the migratory birds? You surmise?

Mr. PIERCE. I'm not sure I could say that but probably. The Canadas colonized this area on their own. I'm not sure they were even brought into this area. They were introduced in the upper midwest and I think have expanded to these areas.

Mr. SAXTON. I see.

Mr. GILCHREST. Jim, if I could give you an unscientific perspective. I think Mr. Pierce is right when he said the changes in agriculture when they went from growing tomatoes on the Eastern Shore to growing wheat, they had inefficient combines, they left a lot of corn on the ground and things like that. So that the migratory birds, instead of going to North Carolina, they begin to stop

more often on the Eastern Shore and then since then, you know change in climate and patterns and, I remember, and then the change of some of these Canada migratory birds stopping in New Jersey, Pennsylvania and New York, mild winters and the whole thing.

But I think it was the change of agriculture that really began the migratory birds from stopping, or started them stopping on the Eastern Shore.

Mr. SAXTON. Thank you very much. I'd like to thank you for your insights and also Mr. Gilchrest for his great effort on this nutria problems. Members of the Subcommittee may have some additional questions for the witnesses and we will ask you to respond to them in writing. The hearing record will be kept open for 30 days for your responses. If there is no further business, the chairman again thanks the members and the Subcommittee, and our witnesses as well.

The Subcommittee stands adjourned.

[Whereupon, at 3:46 p.m., the Subcommittee adjourned subject to the call of the Chair.]

[Additional material submitted for the record follows.]

STATEMENT OF GLENN A. CAROWAN, JR, REFUGE MANAGER, BLACKWATER NATIONAL WILDLIFE REFUGE, CAMBRIDGE, MARYLAND, UNITED STATES FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

Mr. Chairman, I appreciate this opportunity to be here today to discuss the Fish and Wildlife Service' efforts, along with many other interested parties, to control nutria at Blackwater National Wildlife Refuge and elsewhere. I began my career with the U.S. Fish and Wildlife Service (Service) 28 years ago at Mattamuskeet National Wildlife Refuge (NWR) in North Carolina, and after many other assignments became manager at Blackwater NWR in June 1989.

Damage caused by nutria is a major problem at Blackwater and elsewhere in Maryland and in the southern United States. Tidal, fresh-to-brackish water marshes along the Eastern Shore of Maryland are some of the most biologically productive, ecologically valuable, and economically important habitats in the United States. Unfortunately, they are disappearing at an alarming rate. Since 1938, thousands of acres of brackish tidal-marshland, dominated by Olney three-square bulrush *(Scirpus americanus)* and other emergent plants, have been degraded and converted to open-water habitat along Maryland's lower Eastern Shore.

Marsh losses may be most severe on and around the Blackwater National Wildlife Refuge in Dorchester County, which currently includes approximately 10,000 acres of combined vegetated marsh and open-water habitat. Refuge biologists estimate that over 7,000 acres of vegetated marsh have been lost along the Blackwater River in the past half century, and that the rate of loss has accelerated substantially during the past decade (as much as 500 acres a year in recent years). Resource managers fear that these wetlands, which provide significant ecological, cultural, and economic benefits, will continue to disappear at an increasing rate unless prompt action is taken.

The Olney three-square bulrush that dominates these habitats on Maryland's Eastern Shore is a vital component of the brackish tidal-marshes. The rhizomes of these plants form a dense root mat that retains sediments and stabilizes the marsh. The structural integrity provided by these root mats promotes habitat diversity and determines the functional qualities of the marsh. These coastal marshes provide extraordinarily valuable ecological services and human benefits. For example, decomposing marsh plants provide detritus that supports the food-web of the Chesapeake Bay estuary. Commercial and non-commercial fish and shellfish depend upon the efficient transfer of primary to secondary production that occurs in these marshes, and many species depend upon these habitats as feeding and nursery grounds. Approximately 35 percent of all migrating waterfowl in the Atlantic Flyway depend on these marshes as resting and feeding sites. Bald eagles fish and scavenge the marshes to support the largest nesting population of this species north of Florida on the Atlantic Coast. A half billion dollar a year sport fishing industry is directly linked to the productivity of Maryland's marshes, as is an impressive commercial blue crabbing, oystering, and fishing industry which is also valued in the millions of dollars.

Costanza and Farber, in their report on "The Economic Value of Wetlands in Terrebone Parish Louisiana" estimated the value of the coastal marshes to be $28,200/acre/year for all types of economic benefits and recreational activities. Based on the Louisiana estimate, the 10,000 acres of existing and potentially recoverable marshland on Blackwater Refuge can therefore be estimated to be worth about $282,000,000 a year (for all types of economic uses and benefits including, but not limited to, sport and commercial fishing, hunting, wildlife observation, and a wide variety of ecotourism activities). However, such economic assessments, while important to the economic well-being of Maryland, do not begin to account for the myriad of other ecological functions provided by these marshes such as nutrient removal, erosion and flood water control, improved water quality, and exceptional wildlife habitat. The health and stability of Chesapeake Bay wetlands contributes directly to the quality of life for Maryland residents.

The decline of these tidewater marshlands along Maryland's lower Eastern Shore and the resultant adverse environmental, economic, and cultural effects may be due to several factors; however, recent acceleration in marsh loss appears to be directly related to increases in populations of nutria *(Myocastor coypus).* Nutria are alien, non-indigenous species that are highly invasive. These semiaquatic rodents are equipped with long front teeth and powerfully clawed feet that enable them to excavate the root-mat and devour up to 25 percent of their body weight a day. Nutria often grow up to 3-feet long, and can weigh up to 30 pounds. They are extremely prolific animals, reach sexual maturity at four to six months, breed year-round, and produce average litters of four to five offspring, two or three times a year. Picture

a pack of brown Pac Men with a taste for precious marshland, and you have a fairly good concept of nutria.

Nutria are indigenous to South America; their original range was in Argentina, Bolivia, Brazil, Chile, Paraguay, and Uruguay. Fur-farming introductions extended that range into the United States between 1899 and 1940 with introductions into California, Washington, Oregon, Michigan, New Mexico, Louisiana, Ohio, and Utah. But fur-farming attempts failed due to high mortality rates and low reproductive success in captivity. Many of the nutria were freed into the wild when the businesses failed in the late 1940s. State and Federal agencies and individuals translocated nutria into Alabama, Arkansas, Georgia, Kentucky, Maryland, Mississippi, Oklahoma, Louisiana, and Texas with the intent that nutria would control undesirable vegetation and enhance trapping opportunities. Nutria were also sold as "weed cutters" to an unsuspecting public throughout the Southeast, and a hurricane in the late 1940s scattered nutria over wide areas of coastal Louisiana and Texas.

Accidental and intentional releases have thus led to widespread and localized feral populations in 22 states and Ontario, and to reports of sightings in at least 40 states and three Canadian provinces in North America. The other states with established populations include Delaware, Florida, Idaho, Missouri, North Carolina, and Virginia. Range expansion of this highly adaptive rodent seems to be limited only by extreme cold. All national wildlife refuges and wildlife departments in the 22 states with established nutria populations are currently being surveyed to determine nutria abundance, habitat damage, and management activities.

The first recorded introduction of nutria in Maryland occurred in 1943, although it is probable that nutria were first released in Maryland's lower Eastern Shore marshes in the late 1930s. The Fur Animal Station on the Blackwater National Wildlife Refuge was in operation from 1939 to 1947, and during that time nutria were reared in captivity for experimental purposes. In 1943, nutria reportedly escaped from the pens. In the spring of 1951 and summer of 1952, adjacent landowners released 5 pair of nutria on Coles Creek marsh and 20 nutria on Gibbs marsh at Meekins Creek, respectively. In 1956, refuge personnel were instructed to remove nutria from the refuge by any means available. During 1957-59, it appeared that the nutria population on the refuge was under control.

However, during these years, nutria populations on adjoining private marshlands exploded, and animals eventually found their way onto the refuge once again. From 1962 through 1968, the population on the refuge was estimated at less than 150 nutria per year. But the population made a giant leap in 1969 to an estimated 2,075. By 1976, the population had expanded even further, and 2,894 nutria were harvested on the refuge. The total harvest of Maryland nutria fluctuated between 1,500 and 5,000 from 1971 to 1976. During the 1976-77 trapping season, the harvest peaked at a record 29,679 (due to increased market, ideal trapping conditions, and trapper interest.) In the winter of 1976-77, an estimated 90 percent of the Maryland population froze to death during a prolonged period of freezing in January and February of 1977. The population quickly recovered, and by the late 1980s State-wide estimates were higher than ever before. From 1990 through 1997, 35,000 nutria were killed on Blackwater Refuge alone. On Tudor Farms, an adjoining privately owned tract in Dorchester County, between 4,000-5,000 are harvested annually. The current refuge population is estimated to range from 35,000–50,000, but there is the need for more rigorous studies to validate these numbers.

Alarmingly, nutria numbers and their range appear to be increasing and expanding, as considerable amounts of marsh damage is occurring and there are numerous new sightings on the western shore in the Patuxent and Potomac Rivers.

The story is very similar, but even worse in Louisiana where thirteen nutria were released in 1937; by the late 1950s that population was estimated to exceed 20 million animals. Populations in the United States are most dense along the Gulf Coast of Louisiana and Texas. In Louisiana, autumn densities of about 18 animals per acre have been recorded in freshwater marshes. In Oregon, summer densities in freshwater marshes may be as high as 56 animals per acre, while on Blackwater Refuge, population densities range from 1 to 6 animals per acre (with 3.3 animals per acre being the average during the last population survey in 1995).

Nutria have devastating effects on marsh vegetation because they forage on rootstalks and excavate entire plants. At Blackwater, 80 percent of their diet is composed of three-square bulrush. The result is that they not only denude the marsh, they also destroy the root mat that is the structural fabric holding the marsh Together. Furthermore, nutria fragment the marsh with innumerable swimming canals, which serve to focus tidal currents and promote erosion, leading to the lowering of the marsh and conversion of emergent marsh to open water. Nutria, however, are not limited to causing damage to the marshlands. In many states, they are also

responsible for damage to forested wetlands, bald cypress restoration efforts, agricultural crops, and levees. Nationwide, nutria may pose significant ecological and economic impacts.

While nutria may be the dominant factor contributing to marsh loss, it is likely that other forces, including increased salinity (due to land subsidence and sea-level rise), play a role in determining the ecological structure and function of these tidal marshes. Resource managers have little power to control land subsidence, sea-level rise, and salinity changes, but nutria populations can be controlled for the benefit of the marsh ecosystem. Therefore, an effective plan to preserve and restore these fragile brackish tidal-marshes and their ecological, cultural, and economic values must involve efforts aimed at eradicating nutria; wetland restoration efforts would be severely jeopardized if nutria were allowed to continue foraging.

Accordingly, 17 Federal, state, and private organizations have joined forces since 1993 to develop a plan to determine the feasibility of eliminating nutria from Maryland. The initial phase of this effort, entitled "Marsh Restoration: Nutria Control in Maryland," is based upon years of collaboration among the partners; input from private landowners, trappers, watermen, scientists, marsh ecologists, and animal control experts; recommendations from private and agency wetland restoration experts; and recommendations from Dr. L.M. Gosling, a world renowned nutria expert from Great Britain. Dr. Gosling planned and supervised Great Britain's successful 1O-year nutria eradication program, and was invited to visit the Eastern Shore by the Maryland Department of Natural Resources in 1994.

His recommendations have helped guide many of our efforts to date. Based on both his successes and failures in Great Britain, he recommended that the first strategy should be to confirm that nutria were the primary cause of the extensive damage to the marshland ecosystem. To accomplish this, he recommended that a series of enclosures be randomly erected in the Blackwater/Fishing Bay marshes to measure the impact of nutria damage, and to demonstrate the ability of the marsh to recover. This research activity has been conducted in a joint effort between the State of Maryland's Department of Natural Resources and U.S. Geological Survey's Patuxent Wildlife Research Center. Mr. Michael Haramis will testify to the details of this study, "The Effect of Nutria *(Myocastor coypus)* on Marsh Loss In The Lower Eastern Shore of Maryland: An Exclosure Study." Preliminary results of the study indicate that nutria are indeed greatly accelerating marsh loss.

Secondly, Dr. Gosling strongly recommended that a pilot eradication scheme be designed to help estimate the size of the trapper force required, and to gain more information on nutria behavior and movements to help plan trapping tactics in more extensive marshland areas. Dr. Gosling also recommended that we test a trapping organization, establish the strategic deployment of trapping effort based on catch per unit effort, evaluate trapping techniques on target and non-target species, determine changes in reproduction as population size changes, and develop public awareness about the need to control nutria within Maryland (and other areas of the country). The proposed pilot program includes all these recommendations, and additionally includes an experimental wetlands restoration demonstration project. Several of our partners have agreed to help in educating the public about the importance of nutria eradication.

The pilot program, a copy of which I am providing for the record, has generated high hopes for halting marsh loss. In answer to the question, "Is it possible to eradicate nutria in Maryland?", Dr. Gosling's assessment is that "a number of factors make the prospects of eradication in Maryland even more likely than they were at a comparable stage in England. These include a more efficient trapping technique, better mobility over water, and lower population fecundity. Experience in England has shown that it is possible to eradicate a substantial nutria population over a large area of wetland habitat, and given the successful resolution of the issues (in the pilot eradication scheme discussed above), there is no impediment to eradication." Dr. Gosling concludes by saying, "On balance, the factors favoring eradication outweigh potential obstacles, and it could be possible to complete the task more quickly than in England."

The National Wildlife Refuge System exists for the protection and management of plants and animals native to the United States. The policy of the Service is to prevent further introduction of exotic species on national wildlife refuges, and to protect trust resources from the adverse impacts of competing with exotic species. Therefore, in addition to being extremely important to the future of Blackwater National Wildlife Refuge, the information gained from the pilot program will also be applicable to other refuges within the National Wildlife Refuge System (NWRS), to state-managed areas, and to private marshlands throughout the United States and the world. The Maryland Cooperative Fish and Wildlife Research Unit at University of Maryland Eastern Shore is currently surveying all state wildlife agencies and

other units of the NWRS to determine the extent of the nutria problem in an effort to work cooperatively to help address these concerns and educate the public on the national level.

If successful, this program will certainly help Blackwater and other national wildlife refuges achieve the mission of the NWRS and the purposes for which these individual units were established by Congress. The severity of marsh loss and the adverse effects of nutria foraging and burrowing on our forested and emergent wetlands, agricultural areas, dikes and levees, waterfowl management impoundments, water control capabilities, moist soil management areas, and wetland restoration efforts are seriously compromising our ability to achieve our wildlife management objectives, adversely affect the function and productivity of our marshes, disrupt or change cultural activities, significantly harm economic benefits, and have long-lasting environmental consequences as previously noted. Accordingly, we believe that this proposed pilot effort is extremely important to the future welfare of the migratory birds, anadromous fish, and endangered species which the Fish and Wildlife Service has been entrusted to manage for the benefit of the American people.

This concludes my formal statement. I appreciate this opportunity to appear before you, and will be pleased to respond to any questions you may have.

---

STATEMENT OF G. MICHAEL HARAMIS, RESEARCH WILDLIFE BIOLOGIST, U.S. GEOLOGICAL SURVEY, PATUXENT WILDLIFE RESEARCH CENTER, LAUREL, MARYLAND

The purpose of this testimony is to provide information that is relevant to the conservation of the nation's natural resources, and in particular the wetlands of the Blackwater River Basin and adjacent rivers and specifically those wetlands now part of the U.S. Fish and Wildlife Service's Blackwater National Wildlife Refuge, Dorchester County, Maryland. I have been familiar with these wetlands and the marsh loss issue since arriving in Maryland in 1976 when I started my employment as a Research Wildlife Biologist at the Patuxent Wildlife Research Center, now part of the Department of the Interior's U.S. Geological Survey. For the past 3 years, I have been directly involved with the problem of marsh loss in two capacities: first, as a research scientist conducting a cooperative study with the State of Maryland's Department of Natural Resources and the Blackwater National Wildlife Refuge to investigate the role of exotic nutria (*Myocastor coypus*) in the loss of emergent marsh vegetation, and secondly, as a member of a multi-agency task force, including Federal, state, local, and private organizations, to develop a pilot nutria control proposal for Maryland. In reference to these activities, I offer the following comments.

NUTRIA: A BRIEF HISTORY

As brief background, the South American nutria became a subject of attention in the fur industry back in the early 1930s when their large size and high reproductive potential held promise for fur farming businesses in North America. Many hopeful investors started small captive colonies in many locations in the United States, Canada, and many European countries. Many of these farms, however, did not succeed and the animals either escaped or were released to the wild. In some locations feral animals died when released into unsuitable habitat or exposed to severe winter weather. However, nutria populations did develop and persist in many areas. A survey conducted in 1983 found viable populations in 15 states and one Province of Canada; a 1994 survey found nutria in 22 states. Our multi-agency task force is currently conducting a new survey to update this information.

In Louisiana and Maryland marshes, escaped nutria found a suitable natural environment, both a rich food base and favorable climate, and large populations developed as a consequence. Maryland's population is relatively small in comparison to Louisiana where the annual harvest was about 1 million pelts annually in the mid-1980s.

With few natural predators and a decline in fur demand, nutria populations have at times experienced severe overpopulation. These periods of overpopulation have brought severe damage to marshes through the animal's intense feeding on emergent plants. Over time, resource managers recognized that these populations could not be controlled or managed by traditional harvest methods because of (1) lack of harvest incentive (inferior fur quality, declining fur markets) and (2) the animal's own high survival (lack of predators) and remarkable productivity. Nutria may reproduce throughout the year depending on food availability and climate; they may produce 3 litters per year and average 5 young per litter.

Nutria also are not popular with trappers: in comparison to the native muskrat (*Ondatra zibethicus*) they are too large to carry, hard to skin and only a portion of the fur is of value. Average-sized nutria are 8-18 pounds (4-8 kilograms) or 5-10

times the size of muskrats. Where the larger, more aggressive nutria has become abundant, the muskrat has declined through competitive displacement. Nutria are semi-aquatic surface feeding herbivores that can be extremely destructive to marsh vegetation. Their beaver-sized incisors and powerful forefeet allow them to forage directly on the marsh root mat, leaving the marsh pitted with holes and deep swim canals. No other marsh herbivore as large and destructive to wetland vegetation as nutria has ever existed in the Blackwater Basin during the entire development of these marsh ecosystems in the post-glacial period.

ROLE IN MARSH LOSS

At the Blackwater National Wildlife Refuge, Olney three-square bulrush (*Scirpus americanus*) is the food plant of choice for nutria. Results of a recent study on the refuge found a loss of 3,500 acres of mostly Olney marsh to open water since 1938; 53 percent of remaining marsh was considered in unhealthy condition and likely to be lost in the near future. Why is this marsh disappearing and what role do nutria play in this event and in the continuing process of marsh loss?

It is my view that while other factors may also be contributing to marsh loss, nutria are the primary force that has accelerated the rate of marsh loss in this basin by attacking the very structure that holds the marsh together, the vegetative root mat. The root mat has been especially critical because much of the marsh in the Blackwater Basin is a type of floating marsh above a layer of fluid mud. Once the nutria chew through the mat and expose the mud to erosional forces of tidal current and wave action, the marsh surface sinks and the vegetation is lost to inundation. The particular vulnerability of the interior marsh to nutria damage is likely the reason why marsh loss did not occur near the mouth of the Blackwater River (source of rising water), but in the interior basin many miles up-river where this delicate Olney marsh was under attack by foraging nutria.

It is likely that stress from marsh inundation reduces plant vigor by inhibiting plant germination, growth, ability to recolonize denuded areas, or recovery from nutria grazing. Clearly, plants that are stressed from too much water from flooding are unable to recover from damage by nutria. It is impossible to accurately reconstruct past events and there are many other subtle factors continuing to operate that affect the health of the marsh. Nonetheless, it is my opinion that nutria foraging activity likely initiated and certainly greatly accelerated the rate of marsh loss in the Blackwater Basin. I conclude that an overabundance of nutria is the major factor in the observed rapid conversion of emergent marsh to open water along the Blackwater River.

THE NUTRIA EXCLOSURE STUDY

In 1995 I became directly involved with the marsh loss issue when I began a cooperative study with the Maryland Department of Natural Resources and the Blackwater National Wildlife Refuge to investigate the role of nutria in the loss of emergent marsh on the Refuge. My study proposed using fenced enclosures to eliminate nutria herbivory and measure the subsequent vegetative response. Specifically, this experimental approach would determine whether in the absence of nutria the marsh vegetation could stabilize and recover from nutria damage. Conducting this enclosure study was the first of several recommendations made by the British researcher Dr. L.M. Gosling, who assessed Maryland's nutria/marsh loss issue at the request of the Maryland Department of Natural Resources in 1994. Dr. Gosling had successfully removed nutria from a marsh in England in a 10-year trapping campaign that is well documented (see Literature Cited at the end of this report).

In my study, large 100 x 100 ft plots were selected to maintain the ecological integrity of fenced plots and minimize physical effects of enclosure. The size of these enclosures, requiring over 1.4 miles of fencing, make this one of the largest enclosure studies of its kind. Nineteen randomly selected control plots and 19 paired plots (adjacent to fenced enclosures) were also included in the study to test for possible differences in nutria densities. I wanted to be reassured that densities at random control and random treatment (fenced sites) were similar. This is important because if by chance densities were different at the fenced and unfenced sites, it could bias the results of the study. Vegetative coverage was measured through spring and fall measurements of 346 fixed subplots and helicopter photography of whole plots.

Preliminary results following one growing season indicate that the vegetative response is as predicted, i.e. moderate expansion of vegetation within enclosures, and a measured reduction outside. Although the magnitude of this response within enclosures was not great, it is positive evidence that (1) nutria activity is contributing to marsh loss and (2) the marsh is showing some capability of recovering in the absence of nutria foraging activity. However, vegetative recovery is likely limited because of elevation differences between the vegetative surface and the adjacent

denuded marsh surface. It is clear that the cumulative sediment transport processes are negative on the marsh surface (erosional) and without the vegetation to stabilize the marsh, the mostly organic debris torn up by nutria simply washes away.

The sensitivity of the marsh surface to erosion is significant because it indicates that in the absence of nutria, only partial recovery of vegetation can be expected unless restoration is done to fill in eroded areas or otherwise augment the elevation of the marsh surface to a level conducive to vegetative growth.

Damage from nutria occurs along a gradient from light to heavy. Plots that have lost more than 70 percent of vegetation, and exhibit only scattered tufts of remaining vegetation are essentially unrestorable without invasive procedures. Sites where damage has been light and little erosion has occurred, seem to have a good chance of recovery if protected from nutria. Unfortunately a large percentage of the marsh exhibits cumulative damage from nutria over the past several decades and seems to have little restoration potential because the damage has progressed too far. As a matter of fact, two of my plots completely eroded away in the early phase of the study and had to be relocated; 3 other plots are now on the edge of large areas completely denuded of vegetation. A number of growing seasons is required before making more definitive statements about recovery potential. I note that in the current year I have also included in my study an investigation of the effects of elevation change on plant recolonization. This study is scheduled to continue through 1999.

NUTRIA ERADICATION

I have been a member of the nutria eradication proposal task force since its inception and wish to make some comments about the pilot control initiative. First, much of the plan was originally derived from recommendations from Dr. Gosling, who forwarded a very well formulated eradication plan to the State of Maryland Department of Natural Resources. Dr. Gosling is the only person who has experience with a large-scale, long-term nutria eradication program, and I might add, a successful one. Dr. Gosling's success is remarkable because he was constrained to use live traps for capturing nutria in Great Britain, and not the more effective traps available in the United States. Dr. Gosling is a research scientist and conducted his experiment in eradication in a systematic and well documented way. It is a consensus of our task force that our plan must also incorporate the research needed to document the process and especially the population effects related to removal of nutria. This is essential if the work is to be properly evaluated and documented. Also, the research component is essential to fill in information gaps in our knowledge, for instance, in determining the most effective trapping procedures or the best marsh restoration methods.

I wish to mention the diverse partnership involved with this initiative. At last count at least 17 different partners, including several from the private sector, are actively involved in the proposal's design and in contributing time, equipment, facilities, and dollars. Their commitment helped to create a diverse base of support for the proposal.

Lastly, the task force reached a noteworthy consensus during its deliberations. All members are well aware that although nutria have been a management problem for many years, no program has ever been adopted at a proper scale to address the issue. Thousands of acres of marsh have been lost in Maryland. The task force believes that marsh loss can be mediated by controlling and eventually eliminating nutria from Maryland. This concludes my statement, and I will be pleased to respond to any questions.

LITERATURE CITED

Gosling, L.M. 1989. Extinction to order. New Scientist, 4 March 1989:44-49.

Gosling, L.M. 1994. Towards an eradication plan for nutria in Maryland, a report to the Maryland Department of Natural Resources. 14 April 1994. 14pp.

Gosling, L.M., and Baker, S.J. 1987. Planning and monitoring an attempt to eradicate coypus from Britain. Symp. Zool. Soc. Lon. 58:99-113.

Gosling, L.M., Baker, S.J., and Clarke, C.N. 1988. An attempt to remove coypus (*Myocastor coypus*) from a wetland habitat in East Anglia. J. Appl. Ecol. 25:49-62.

---

STATEMENT OF DR. SARAH J. TAYLOR-ROGERS, PH.D., FOR THE MARYLAND DEPARTMENT OF NATURAL RESOURCES

Mr. Chairman, my name is Dr. Sarah J. Taylor-Rogers. I am the Assistant Secretary of Resource Management for the Maryland Department of Natural Resources. On behalf of the State of Maryland, I appreciate the opportunity to address this

Subcommittee on initiatives relating to control of expanding nutria populations within our State.

PROBLEM STATEMENT

Nutria are an invasive, semi-aquatic South American rodent. This non-native species was first introduced into Dorchester County, Maryland in 1943. Nutria are a foreign addition to Maryland's wetland ecosystems, therefore no inherent biofeedback mechanisms exist to naturally control their populations. Consequently, succeeding population increases and range expansion has now resulted in established populations in at least 8 counties. Population estimates on the 10,000 acres of Blackwater National Wildlife Refuge have grown from less than 150 animals in 1968 to between 35,000 to 50,000 currently.

Loss or degradation of Maryland's coastal marshes has reached alarming proportions. It is estimated that up to 65 percent of our wetlands have been lost since the 1700's. Nutria feeding behavior damages or destroys the root mat that cements the marsh together. When this fibrous network is compromised, emergent marsh is quickly reduced to unconsolidated mudflats. These areas in turn are highly susceptible to erosional processes and are eventually converted to open water. While nutria are not the sole reason for marsh loss, they have been implicated as the catalyst that has greatly accelerated losses during the last decade. Annual loss rates at Blackwater National Wildlife Refuge are now approximately 5 percent of total vegetated acreage.

Although this project focuses primarily on Blackwater NWR, the 10,000 acres of the refuge only represents a small portion of the nutria's occupied range in Maryland. Maryland's problems encompasses a much larger scale and scope than those described in this proposal. However, the accompanying scientific investigations are the first logical step in addressing our problems.

Current efforts have evolved to the inclusive, systematic strategies now presented to Congress (see attached proposal). A brief synopsis of the labors that led to this hearing is as follows:

CHRONOLOGY OF APPROACH

**1989**

During the mid-1980's Maryland's non-native nutria population exhibited seemingly exponential growth rates. Likewise, resident population densities, occupied range and accompanying marshland degradation paralleled these increases. This prompted the Maryland Department Of Natural Resources (DNR) to initiate the CUE (catch per unit effort) project in 1989 to assess nutria population characteristics. The study generally supported qualitative field assessments of rapidly increasing populations.

**1993**

DNR formed the first multi-agency nutria task force. The group was charged with the overwhelming responsibility of development or a workable approach to control of non-native nutria populations. Efforts of the task force resulted in completion of the first draft eradication plan. The concept of nutria eradication also received legislative support in 1993 with the passage of Senate Bill 27. This legislation mandated that 50 percent of the proceeds from the sale of State duck stamps be designated for nutria control.

During preparation of the 1993 plan, literature searches revealed that successful nutria eradication efforts had been completed in East Anglia, Great Britain. Under the direction of Dr. Morris Gosling, the Coypu (nutria) Research Laboratory, and the Coypu Control Organization reversed decades of futile efforts and eradicated the entire resident nutria population during the 1980's. This victorious endeavor resulted from the marriage of systematic applied research and field control activities (see attached "Extinction to Order," M. Gosling). These successes led DNR to solicit critical review of our initial plan from Dr. Gosling.

**1994**

Communications with Dr. Gosling highlighted the complexities of a large scale eradication program. Upon realization of the enormity of the task before us, DNR entered into a contractual agreement with Dr. Gosling to provide technical expertise in development of a revised eradication plan.

Dr. Gosling completed field assessments of Maryland's nutria population and occupied range, and submitted his recommendations to DNR. He felt that eradication in Maryland was an achievable goal, however basic natural history and control strategy information had to be obtained prior to the implementation of control efforts.

Dr. Goslings expertise and comments were then synthesized with the initial eradication plan. Project descriptions were developed, and resulted in production of the initial working concepts of our current proposal entitled "Marsh Restoration: Nutria Control in Maryland." All of our ensuing efforts have closely paralleled the recommendations offered by Dr. Gosling.

**1995**

Quantifiable data documenting the deleterious consequences of established nutria populations is critical to enlisting public understanding and support. Accordingly, in 1995 DNR entered a joint research endeavor with the U.S. Geological Survey, Patuxent Wildlife Research Center designed to assess the impacts of nutria grazing on marshland vegetative communities. This study entitled "The Effect of Nutria (*Myocaster coypus*) on Marsh Loss in the Lower Eastern Shore of Maryland: An Exclosure Study" has proven to be the largest investigation of it's kind ever initiated in a marshland ecosystem. Mike Haramis, the project's principle investigator will provide accompanying testimony on preliminary findings of this study.

**1997**

The DNR and U.S. Fish and Wildlife Service have continually solicited critical input of the draft eradication plan. These requests led to convening of a "Nutria Control Summit" meeting in 1997. Representatives of various agencies, organizations, and disciplines contributed valuable insights and perspectives to augment the existing plan.

As a result of this meeting, 17 governmental agencies and private organizations formed partnerships and appointed two complimentary task groups. The first was an expanded technical committee which was charged with refinement the draft plan's experimental design, and development of the three year pilot project. The second committee was charged with development of a public education campaign to cultivate support for the program.

**1998**

Both of these committees have worked in unison to produce the proposal with which you are now presented. The attached document entitled "Marsh Restoration: Nutria Control in Maryland" details the specific approaches necessary to ultimately address control of nutria populations.

THE PLAN

History has demonstrated that normal commercial harvest of nutria is not adequate to substantially reduce population levels. Prolific reproductive rates and adaptability in response to high mortality rates have allowed nutria populations to expand through time. Detailed records kept on a 7,000 acre landholding adjacent to Blackwater National Wildlife Refuge document this phenomena. Nutria population densities and associated ecological damage on this parcel continue to increase in spite of sustained annual harvests of approximately 25 percent to 35 percent of the total population.

As demonstrated by Dr. Gosling, the key to successfully eradicating nutria is to modify existing harvest equipment and strategies. The information necessary to capitalize on critical behavioral traits and characteristics can only be obtained through the systematic, and quantitative investigations included in the attached proposal. Accurate home range, movement, reproductive and control equipment evaluation data is essential to the development of efficient harvest strategies.

Key components of the proposal and brief descriptions are as follows:

1. Impacts of nutria on marsh ecosystems (enclosure study).

This cooperative research endeavor will quantitatively document the impacts on plant species composition and densities in marshland vegetative communities. This data will be employed by public education personnel to garner the public support necessary for an eradication project.

2. Nutria natural history characteristics.

(a) Temporal, spatial and gender specific home range characteristics.

A variety of techniques including radio-telemetry, mark recapture, and Forward Looking Infra-red Radar will be utilized by researchers to assess these behavioral manifestations. A basic understanding of when, where, why and how animals occur and travel is necessary for control personnel to develop efficient harvest schemes.

(b) Reproductive characteristics.

Reproductive dynamics including age of sexual maturation and failure, compensatory reproductive rates, litter size, and average number of litters per year are essential to predicting control personnel force size and control in-

tensity levels. Researchers will obtain this information by performing necropsies on animals supplied by the control unit.

3. Pilot Control Project.

(a) Develop and evaluate control equipment and strategies.

Eradication based harvest schemes will require evaluation and modification of existing control equipment, as well as development of new and innovative apparatus. Likewise, current sustained yield harvest strategies will require systematic alterations. Information supplied by project researchers will enable control personnel to investigate and modify all of these parameters.

(b) Age and gender specific harvest characteristics.

When population densities are reduced to a critical level, harvest efficiency may dictate targeting specific age classes or gender for maximum reduction values. Research and control personnel will work cooperatively to obtain this mutually beneficial information.

4. Marsh restoration.

(a) Investigate recuperative capabilities of degraded marshland ecosystems.

Researchers will determine the gradient of recovery for untreated marsh vegetative communities when nutria are removed.

(b) Investigate mechanical techniques for restoration of severely degraded marshland ecosystems.

Researchers will evaluate if changing elevational levels of degraded marsh through the application of sediments will facilitate recovery of severely degraded areas. The treatments will be applied in areas with and without nutria present.

5. Public education and support.

Information supplied by both research and control personnel will be crafted by education specialist into a media campaign that conveys the urgency and inherent value of the eradication project to the general public.

This body of work is the culmination of over nine years of labor by recognized experts in the biological science. It represents the best available, systematic and scientifically based approach to resolution of an extremely urgent problem. Thank you for your consideration.

# Marsh Restoration: Nutria Control in Maryland

## Pilot Program Proposal

Representing Partnerships with:

U.S. Fish and Wildlife Service
Maryland Department of Natural Resources
Maryland Cooperative Fish and Wildlife Research Unit
Wildlife Services, Animal & Plant Health Inspection Service
The Salisbury Zoological Park
Patuxent Wildlife Research Center
University of Maryland
Ducks Unlimited
Tudor Farms
Americorps

edited by Dixie Bounds

July 10, 1998

# Table of Contents

## EXECUTIVE SUMMARY
## Marsh Restoration: Nutria Control in Maryland
## Pilot Program Proposal

Chesapeake Bay wetlands are recognized as some of the most important wetland areas in the United States and have received global recognition as "Wetlands of International Importance" under the 45-nation Ramsar Convention treaty (Tiner and Burke 1995). Maryland's wetlands are used for fishing, hunting, trapping, bird watching, wildlife viewing/photography, berry and timber harvest, agriculture and livestock production. Wetlands also aid in maintaining environmental quality by purifying natural waters through removal of pollutants, excess nutrients, and sediments, and by producing foods that support aquatic life. Maryland's wetlands serve as important spawning or nursery sites for many finfish and shellfish species. For example in 1995, landings for the blue crab, which is Maryland's most abundant and valuable shellfish species, were 40.3 million pounds valued at $29 million (Holiday and O'Bannon 1996).

In addition, the Chesapeake Bay is vitally important to birds. About one million waterfowl winter on the Chesapeake Bay which represents 35% of all waterfowl in the Atlantic Flyway (Chesapeake Bay Program 1990). Over 4,500 jobs and $31 million in state and federal tax revenues are directly related to hunting and non-consumptive activities associated with migratory waterfowl and bird use in Maryland (Southwick Associates 1995). The overall economic benefits to Maryland from hunting waterfowl and other wildlife species dependent on wetlands is estimated at over $300 million annually (U.S. Fish and Wildlife Service 1995).

Wetlands are among the most productive ecosystems in the world, yet over half of the Nation's original wetlands have already been destroyed. Since the 1700s, Maryland has lost between 45-65 percent of its wetlands with the greatest losses occurring on the Eastern Shore (Tiner and Burke 1995). Historically, this decline has largely been the result of human habitat alterations. Despite state and federal laws and regulations protecting these areas, wetlands and tidal marshes throughout

*Executive Summary continued*

the lower Eastern Shore of Maryland have rapidly declined over the last few decades. Resource managers fear that without intervention, these wetlands which provide significant ecological, cultural and economic benefits to the State of Maryland, may completely disappear within the next decade or so.

The principle causes of wetland loss are erosion, land subsidence, sea level rise, and non-indigenous species. The subject of this proposal is a non-indigenous species, nutria. Nutria (*Myocastor coypus*) are semi-aquatic, South American rodents (similar to beavers) that were first introduced throughout the United States in 1899 (Willner et al. 1979). Currently nutria are established in 22 states (Figure 1) and sightings have been reported in 40 states (LeBlanc 1994, Hess et al. 1997). Nutria were introduced in Maryland in the 1950s to promote the fur industry (Maryland Department of Natural Resources 1997).

Nutria are large, surface feeding herbivores that can be extremely destructive to marsh vegetation. These powerful animals forage directly on the vegetative root mat, leaving the marsh pitted with digging sites and fragmented with deep swim canals. In the face of rising sea levels, nutria damage is particularly problematic because it accelerates the erosional processes associated with tidal currents and wave action. For example, the situation is extremely delicate within the tidal marshes of the Blackwater River because much of marsh is underlain by a layer of fluid mud that is easily washed away once the vegetation becomes fragmented. The cumulative result of an overabundance of nutria and rising sea level at Blackwater National Wildlife Refuge has been a rapid conversion of emergent marsh to open water.

Nutria are extremely prolific, reproducing throughout the year and having two to three litters annually (Brown 1975, Willner et al. 1979). On average, nutria have five young, but a female may have as many as 13 offspring per litter (Nowak 1991). Nutria weigh on average up to 18 pounds which is 5-10 times the size of the native muskrats. To compound this problem, there are no natural predators to control nutria and populations have exploded causing significant impacts to native wildlife, fish, shellfish, plants and marsh ecosystems. Maryland's native muskrat

*Executive Summary continued*

(*Ondatra zibethica*) populations are threatened by competition from the nutria and loss of wetland habitats (R. Colona, pers. comm., Maryland Department of Natural Resources).

Nutria are a highly invasive species; there are confirmed reports of nutria from the Chesapeake Bay Bridge to Ocean City, Maryland and south to the Virginia border. Nutria are also on the western shore of Maryland in the Patuxent and Potomac Rivers, and to the northeast in Delaware (R. Colona, pers. comm.,Maryland Department of Natural Resources).

Although nutria were introduced to support the fur industry, private fur trappers have not kept pace with the animal's ability to reproduce. From a fur trappers perspective, nutria are less valuable than other furbearers such as the native muskrat because only a portion of the pelt is usable, the quality of nutria fur is inferior, nutria pelts are time-consuming to process and nutria are heavier to carry out across the marsh than muskrats. In addition, fur markets and the profits from nutria pelts have been subject to fluctuations due to a variety of factors such as the animal right's movement, fashion trends, U.S. exchange rates, and the political and economic trends in consumer nations (Maryland Department of Natural Resources 1997). The difficulty in controlling nutria populations has been demonstrated at Tudor Farms, which is a 7,000 acre privately-owned tract in Dorchester County. Despite an annual harvest of between 4,000-5,000 nutria per year, the nutria population appears to be unaffected. Population estimates range from 13,000 - 20,000 animals (L. Ras, unpubl. data), and nutria continue to degrade the marsh.

Due to the complexity of this problem and the need to take aggressive actions to preserve Maryland's wetlands, 17 federal, state, and private organizations have joined forces to develop a plan to address marsh loss and control of nutria. We propose that the Maryland Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Animal and Plant Health Inspection Service enter into a Memorandum of Understanding (MOU) to implement and facilitate the pilot program in cooperation with other private, state, and federal partners.

*Executive Summary continued*

**Goal Statement:** Our joint goal is to develop methods and strategies to reduce nutria populations in the Chesapeake Bay wetlands to the point where they are unable to maintain a sustainable population, restore marsh habitats, and promote public understanding of the importance of preserving Maryland's wetlands. We recommend implementation of a management, research, and public education program to facilitate nutria control. We suggest immediate initiation of a 3-year pilot control program. Table 1 outlines our proposed activities. The results of the pilot program can then be used in a full-scale effort to control or eliminate nutria and restore the marsh ecosystems in Maryland. We believe that by working together and combining federal, state, and private resources we have the greatest chance for success in controlling nutria and preserving Maryland's valuable wetlands.

The following agencies have offered to contribute in-kind services from their existing resources to address the nutria control and wetland restoration, thereby reducing the overall budget request for this program: U.S. Fish and Wildlife Service, Maryland Department of Natural Resources, Maryland Cooperative Fish and Wildlife Research Unit, Ducks Unlimited, University of Maryland, and privately-owned Tudor Farms. These organizations will contribute a total of $902,280. The total budget request to implement the proposed 3-year program is $2,884,616.

**Budget Summary: 3-Year Program**

| ITEM | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| Salaries | 635,850 | 651,650 | 667,950 | 1,955,450 |
| Equipment | 405,910 | 58,500 | 58,500 | 522,910 |
| Supplies | 2,750 | 3,750 | 3,750 | 10,250 |
| Public Education | 35,000 | 12,500 | 12,500 | 60,000 |
| Wetland Restoration Demo. | 266,090 | 25,708 | 26,208 | 321,006 |
| Exclosure Study | 5,000 | 5,000 | 5,000 | 15,000 |
| **ANNUAL REQUESTS** | 1,350,600 | 757,108 | 773,908 | |
| **TOTAL 3-YEAR BUDGET REQUEST** | | | | **$2,884,616** |

5

***IN-KIND CONTRIBUTIONS FROM PARTNERSHIPS***

| | | | | |
|---|---|---|---|---|
| U.S. Fish and Wildlife Service | 124,550 | 27,250 | 27,250 | 179,050 |
| MD Coop Fish & Wildlife Research Unit (USGS) | 116,300 | 96,300 | 96,300 | 308,900 |
| Maryland Department of Natural Resources | 61,000 | 52,000 | 52,000 | 165,000 |
| Tudor Farms | 63,600 | 63,600 | 63,600 | 190,800 |
| Ducks Unlimited | 5,000 | 5,000 | 5,000 | 15,000 |
| University of Maryland | 14,510 | 14,510 | 14,510 | 43,530 |
| **TOTAL IN-KIND SERVICES** | 384,960 | 258,660 | 258,660 | 902,280 |

**BUDGET SUMMARY**

| | | | | |
|---|---|---|---|---|
| Budget Request | 1,350,600 | 757,108 | 773,908 | 2,884,616 |
| In-Kind Contributions | 384,960 | 258,660 | 258,660 | 902,280 |
| Total Program | 1,735,560 | 1,015,768 | 1,032,568 | 3,786,896 |

*Acknowledgments*

We thank everyone who participated in the multi-agency meeting to create this plan:

| Name | Affiliation |
|---|---|
| Kathi Bangert | U.S. Fish and Wildlife Service |
| Peter Bergstrom | U.S. Fish and Wildlife Service |
| Dan Bierly | U.S. Army Corps of Engineers |
| Nick Carter | Maryland Department of Natural Resources |
| Jeffrey Cornwell | University of Maryland, Horn Point |
| Doug Forsell | U.S. Fish and Wildlife Service |
| Bill Giese | Blackwater National Wildlife Refuge |
| Keren Giovengo | U.S. Fish and Wildlife Service |
| Charles Hocutt | University of Maryland Eastern Shore |
| Pete Jayne | Maryland Department of Natural Resources |
| Sherry Johnson | U.S. Fish and Wildlife Service |
| Dennis King | University of Maryland (CEES) |
| Tom Mathews | Maryland Department of Natural Resources |
| Jim Nichols | Patuxent Wildlife Research Center (USGS) |
| Lara Ras | University of Maryland Eastern Shore/Tudor Farms |
| Kathy Reshetiloff | U.S. Fish and Wildlife Service |
| Eric Schwaab | Maryland Department of Natural Resources |

| Name | Affiliation |
|---|---|
| Chris Spur | U.S. Army Corps of Engineers |
| J. Court Stevenson | University of Maryland, Horn Point |
| Les Terry | Animal & Plant Health Inspection Service (USDA) |
| Toni Danza Thornton | Maryland Department of Natural Resources |
| Guy Willey Sr. | Tudor Farms |

Special thanks go to members of the scientific and public education committees:

| | |
|---|---|
| Andy Baldwin | Univeristy of Maryland (College Park) |
| Ken Bixler | Americorps |
| Dixie Bounds | Maryland Cooperative Fish and Wildlife Research Unit |
| Steve Brown | University of Maryland (CBL) |
| Glenn Carowan | Blackwater National Wildlife Refuge |
| Robert Colona | Maryland Department of Natural Resources |
| John Gill | U.S. Fish and Wildlife Services |
| Mike Haramis | Patuxent Wildlife Research Center (USGS) |
| Liz Kalinowski | Maryland Department of Natural Resources |
| Rick Owens | Animal and Plant Health Inspection Service (USDA) |
| Matt Perry | Patuxent Wildlife Research Center (USGS) |
| Jim Rapp | The Salisbury Zoological Park |
| Sarah Taylor-Rogers | Maryland Department of Natural Resources |
| Ed Temple | Ducks Unlimited |
| Les Terry | Animal and Plant Health Inspection Service (USDA) |
| Josh Sandt | Maryland Department of Natural Resources |
| Britt Slattery | U.S. Fish and Wildlife Service |
| Ed Soutiere | Tudor Farms |
| Keith Weaver | Blackwater National Wildlife Refuge |
| John Wolflin | U.S. Fish and Wildlife Service |

## Action Plan for a Pilot Nutria Control Program in Maryland

### Importance of Maryland's Wetlands

The natural resources of the Chesapeake Bay provide many functions that are highly valued by the public. These natural resources make a significant contribution to the economic well-being of the State of Maryland and to the quality of life of Maryland residents. Chesapeake Bay wetlands are recognized as some of the most important wetland areas in the United States and have received global recognition as "Wetlands of International Importance" under the 45-nation Ramsar Convention treaty (Tiner and

Burke 1995). Maryland's wetlands are used for multiple purposes including fishing, hunting, trapping, bird watching, wildlife viewing/photography, berry and timber harvest, agriculture and livestock production.

Maryland's wetlands serve as important spawning or nursery sites for many finfish and shellfish species including spot, croaker, striped bass, menhanden, herring, white perch, shad, clams, oysters and blue crabs. Major tributaries of the Chesapeake Bay account for about 90 percent of the striped bass spawned on the East Coast (Berggren and Lieberman 1977). Metzgar (1973) found that 44 fish species in Dorchester County used wetlands for spawning, nursery, and adult feeding activities. Some species spend their entire lives in wetland areas. For example, Goodger (1985) found that in Maryland, the American oyster and white perch complete their entire life cycles in estuarine waters.

Chesapeake Bay resources provide over $60 million annually in commercial finfish and shellfish landings. For example in 1995, landings for the blue crab, which is Maryland's most abundant and valuable shellfish species, were 40.3 million pounds valued at $29 million (Holiday and O'Bannon 1996). In addition, $275 million was spent directly on recreational fishing with a total economic impact to Maryland of $524 million.

In addition, the Chesapeake Bay is vitally important to birds including waterfowl, shorebirds, and migratory songbirds. Approximately 348 species of birds have been recorded in Maryland and almost half of those species regularly use wetland areas (Tiner and Burke 1995). About one million waterfowl winter on the Chesapeake Bay which represents 35% of all waterfowl in the Atlantic Flyway (Chesapeake Bay Program 1990). Over 4,500 jobs and $31 million in state and federal tax revenues is directly related to hunting and non-consumptive activities associated with migratory waterfowl and bird use in Maryland (Southwick Associates 1995). The economic benefits to Maryland from hunting waterfowl and other species dependent upon wetlands is estimated at well over $300 million annually (U.S. Fish and Wildlife Service 1995).

Wetlands help maintain environmental quality by purifying natural waters by filtering nutrients, chemical and organic pollutants, and sediments from natural waters, and by producing food which supports aquatic life. Wetlands are excellent water filters because of their locations between land and open water. In addition, wetland vegetation helps minimize shoreline erosion by increasing sediment stability, dampening wave action, and reducing current velocity through friction (Dean 1979).

Wetlands are among the most productive ecosystems in the world, yet over half of the Nation's original wetlands have already been destroyed. Since the 1700s, Maryland has lost between 45-65 percent of its wetlands with the greatest losses occurring on the Eastern Shore (Tiner and Burke 1995). Maryland's remaining wetlands are becoming even more valuable as public resources because this important habitat has been drastically reduced.

Public cooperation and support is a vital component in the effort to conserve the biodiversity and valuable habitat of Maryland's wetlands. A major focus of our plan is to educate the public about the critical importance of wetlands to Maryland's economy, natural resources, and the overall health and productivity of the Chesapeake Bay.

**Problem Statement**

Wetlands and tidal marshes throughout the lower Eastern Shore of Maryland have rapidly declined over the last few decades. For example, at least 7,000 out of 17,000 total acres of marsh have been lost within Blackwater National Wildlife Refuge alone (G. Carowan, pers. comm., Refuge Manager). Resource managers believe that without intervention these wetlands, which provide significant ecological, cultural, and economic benefits to the State of Maryland, the Atlantic Coast, and the Nation, may completely disappear within the next decade. For example, on a local level, Blackwater National Wildlife Refuge, generates approximately $15 million annually in tourism revenue for Dorchester County (W. Roache, pers. comm., Dorchester County Department of Tourism). Tourists visit Dorchester County and other areas on the Eastern Shore to enjoy the native wildlife and natural wetland areas; however, the continued existence of these precious resources is currently threatened.

The decline of wetlands and tidewater marshes is due to several factors including sea level rise, land subsidence, increased salinity, and herbivory by an introduced or non-native species, nutria (*Myocastor coypus*). Nutria are large, surface feeding herbivores that can be extremely destructive to marsh vegetation. Nutria were first introduced throughout the United States in 1899 (Willner et al. 1979). Currently nutria are established in 22 states (Figure 1) and sightings have been reported in 40 states (LeBlanc 1994, Hess et al. 1997).

Nutria forage directly on the vegetative root mat, leaving the marsh pitted with digging sites and fragmented with deep swim canals. In the face of rising sea levels, nutria damage is particularly problematic because it accelerates the erosional processes associated with tidal currents and wave action. The situation is extremely delicate within the tidal marshes of the Blackwater River because much of the marsh

is underlain by a layer of fluid mud that is easily washed away once the vegetation becomes fragmented. The cumulative result of an overabundance of nutria and rising sea level at Blackwater National Wildlife Refuge has been a rapid conversion of emergent marsh to open water.

There are no natural predators to control nutria and populations have exploded causing significant impacts to native wildlife, fish, shellfish, plants and marsh ecosystems. Maryland's native muskrat (*Ondatra zibethica*) populations are threatened by competition from the non-native nutria and loss of habitat (R. Colona, pers. comm., Maryland Department of Natural Resources).

Nutria reproduce throughout the year, having two to three litters annually (Brown 1975, Willner et al. 1979); litter size averages 5 young, but females may have up to 13 young per litter (Nowak 1991). Although nutria were introduced to support the fur industry, private fur trappers have not kept pace with the animal's ability to reproduce. From a fur trappers perspective, nutria are less valuable than other furbearers such as the native muskrat because only a portion of the nutria pelt is usable, the quality of nutria fur is inferior, nutria pelts are time-consuming to process and nutria are heavier to carry out across the marsh than muskrats. In addition, fur markets and the profits from nutria pelts have been subject to fluctuations due to a variety of factors such as the animal right's movement, fashion trends, U.S. exchange rates, and the political and economic trends in consumer nations (Maryland Department of Natural Resources 1997).

Nutria are a highly invasive species; there are confirmed reports of nutria from the Chesapeake Bay Bridge to Ocean City, Maryland and south to the Virginia border. Nutria are also on the western shore of Maryland in the Patuxent and Potomac Rivers, and to the northeast in Delaware.

The difficulty in controlling nutria populations has been demonstrated at Tudor Farms, which is a 7,000 acre privately owned tract in Dorchester County. Despite an annual harvest of between 4,000-5,000 nutria per year, the nutria population appears to be unaffected. Population estimates range from 13,000 - 20,000 animals (L. Ras, unpubl. data) and nutria are continuing to degrade the marsh.

Louisiana is also attempting to control nutria numbers. In 1938, 20 individual nutria were introduced in Louisiana and by the 1950s, nutria populations exceeded 20 million animals (Nowak 1991). By 1962, nutria had replaced the native muskrat as the leading fur bearer in Louisiana (Lowery 1974). In 1998, Louisiana will receive approximately $2 million in federal assistance to control nutria. Staff from Louisiana and Maryland have discussed nutria control and management strategies. However,

important biological information necessary to effectively control nutria populations is still lacking in both states. This plan includes activities to collect the information needed to control nutria in Maryland.

In 1994, the Maryland Department of Natural Resources invited a nutria expert, Dr. L. M. Gosling, to visit the Eastern Shore and assess the situation. Dr. Gosling, who led a 10-year program that resulted in the successful elimination of nutria from Great Britain, pointed out several weaknesses in our information base in Maryland. Dr. Gosling recommended that Maryland immediately implement a pilot management program of intensive nutria control, compare trapping strategies, and learn more about nutria behavior in Maryland using a combination of radio-telemetry and mark/recapture techniques. This pilot program follows the recommendations of Dr. Gosling and represents the combined efforts of 8 federal, 6 state, and 3 private partnerships to address nutria and marsh restoration in Maryland.

Resource managers have little ability to control sea-level rise or land subsidence, but they can actively manage nutria populations to prevent further loss of tidewater marsh ecosystems. An effective plan to preserve and restore Maryland's tidal marshes should involve parallel management, research and public education activities aimed at controlling nutria. By working cooperatively with universities, state, federal and private agencies, we hope to gain a quantitative understanding of the effects of nutria on marsh ecology and opportunities for restoring marsh habitats.

**Partnerships**

Seventeen federal, state, and private organizations have joined forces to develop a plan to deal with marsh loss and control of nutria. Staff from these agencies recognize the severity of the nutria problem and are working together to develop solutions and alternatives to aid in managing the natural resources of the Chesapeake Bay. Our educational and outreach activities will highlight these partnerships so the general public will understand the public and private cooperation at work on the nutria control and marsh restoration program.

Together, we recommend implementation of a management program to investigate nutria control and to quantify the interactive effects of several factors on marsh loss. We suggest immediate initiation of a 3-year pilot program (Table 1). The results of the pilot program can then be used in a full-scale effort to eliminate nutria and restore the marsh ecosystems in Maryland.

**Study Areas**

We propose using 3 study areas for the pilot management program (Figure 2). Two of the areas will undergo intensive trapping/hunting (treatment sites) and 1 area will not be subjected to intensive trapping (control or reference site). We plan to mark nutria in all 3 areas to generate accurate population estimates and to use radio-telemetry to obtain data on nutria movements, behavior, and life history information that is essential in developing a successful statewide nutria eradication program.

**Intensive Trapping and Research Areas (Treatment Areas)**

1. Transquaking/Chicamacomico Rivers including Tudor Farms (3,800 acres).
2. Little Blackwater River/Blackwater National Wildlife Refuge (west of Little Blackwater River, East of Rt. 335, North of Blackwater River, and South of the Wildlife Drive) (2,500 acres).

**Nutria Research Areas (Reference Area)**

3. Head of Fishing Bay (Transquaking/Blackwater Rivers about 2,000 acres).

We acknowledge that the proposed reference or control site may not be an identical replicate of the treatment sites. However, we believe these sites represent the optimal study areas to collect information on the most appropriate strategies for controlling nutria during the pilot program for the reasons outlined below.

**Justification of Study Areas**

1. Transquaking/Chicamacomico Rivers
Tudor Farms, which is located within this site, provides several advantages as a pilot nutria control area. First, there is a baseline data set (trapping, hunting, mark/recapture, limited radio-telemetry) that will enable biologists to make useful comparisons between the pilot control program and past efforts. Second, because this study area is on private land, public access to the lands will be more easily controlled and monitored. Third, the area encompasses 3-square bulrush (*Scirpus olneyi*) vegetation that provides a primary food base for nutria. Fourth, nutria densities are high. Fifth, the private landowners are highly supportive of the pilot control program, willing to grant biologists access to the land, and provide logistical support such as housing for researchers. In addition, there is a geographic information system (GIS) in place which will facilitate tracking animal movements.

2. Little Blackwater River/Blackwater National Wildlife Refuge
Little Blackwater River also provides several advantages as a pilot area. First, nutria densities are high. Second, the potential for nutria to recolonize the area is relatively low due to the geography and isolation of the system. Third, Little Blackwater represents a linear fresh/brackish water system that will provide important data for control efforts in similar habitats throughout Maryland.

Blackwater National Wildlife Refuge (NWR) will provide many advantages as a pilot study area. First, Blackwater NWR has an initial data set (limited trapping, hunting, and mark/recapture) that will allow biologists to make comparisons between the pilot program and past efforts. Second, public access is controlled and access to the area for the pilot program will be readily granted, and the refuge may assist in logistical support. Third, nutria densities are high and appear to be increasing at Blackwater NWR. Fourth, this area includes 3-square bulrush and other marsh vegetation representative of the core nutria habitat in Maryland. Fifth, this Little Blackwater River/Blackwater NWR system will provide an excellent test of the ability of trappers to access difficult wetland areas. During times of heavy trapping pressure, nutria may retreat to the most remote marsh areas. Trappers will be encouraged to develop innovative trapping techniques in these remote areas and also deal with issues such as landowner coordination, hunting uses, and endangered species.

By including areas adjacent to the Wildlife Drive on Blackwater NWR, we can provide interpretative exhibits for the public to learn about the nutria control program and marsh restoration efforts. An educational, continuous loop video would enhance the exhibits. We plan to make extensive use of the visual educational opportunities and public outreach at Blackwater NWR. In addition to the on-site exhibits, we intend to host informational tours for legislators, interest groups (environmental, conservation, animal rights, etc.), media, schools, business groups (trappers, watermen), landowners, and the agricultural community. Such outreach activities would help educate the public about the impacts of nutria.

3. Fishing Bay
Fishing Bay represents an expansive salt marsh ecosystem. This area encompasses large unbroken tracts of marsh interspersed with tidal guts. We do not propose trapping in this area. Instead we plan to mark nutria, develop population estimates, and collect data on nutria movements and behavior to compare with data from areas that are intensively trapped (Transquaking/Chicamacomico Rivers).

**Management of Pilot Nutria Control Program**

We propose that the Maryland Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Animal and Plant Health Inspection Service enter into a Memorandum of Understanding (MOU) to implement and facilitate the pilot program. We also suggest that an advisory team be established to provide advice and guidance for the pilot program and to assist in evaluating the overall success of the program. This advisory team could serve as an independent monitoring body to provide objective direction and guidance for the program. The advisory team could include representatives from the multiple federal, state, and private partners in this joint initiative. As part of our public education activities, we would advise the media and general public that we are receiving scientific guidance from the advisory team.

**Intensive Control of Nutria**

We propose using 3 teams of 2 trappers per team at each treatment area (Transquaking/Chicamacomico Rivers and Little Blackwater River/Blackwater NWR). The 12 trappers (6 trappers at each of the 2 treatment sites) would be supervised by one field supervisor who would report to one program biologist. The biologist would supervise both the trapping and research teams and provide overall coordination for the pilot program. Trapping would be conducted intensively year-round for 3 years during the pilot program.

A combination of different traps (cage, snare, foothold, conibear, drowning cage, floating platforms, baited sites), trapping strategies, and shooting will be used. A variety of trapping methods will be compared to determine trap efficacy and to maximize the number of nutria captured. For example, perimeter trapping will be compared to saturation trapping in order to determine the most effective method. Progressive trapping will be used to cover the entire area under study. Capture/effort indices, video monitoring of baited sites, recovery of marked animals and other methods will be used to determine the thoroughness of nutria removal. We will also collect data on the capture of non-target species to assess which trapping techniques minimize impacts on non-target animals. In addition, trappers will collect data on capture success by set and trap type, and on nutria captured (sex, age, weight, reproductive status, and if the animal was marked or unmarked).

We suggest that funding be included for aircraft time to assist in tracking radio-collared nutria in remote areas. We also request funds to obtain aerial photographs of marsh vegetation to examine the effects of nutria removal in selected areas over time. We will use aerial photographs to educate the public about the impacts of uncontrolled nutria populations and to explain marsh restoration and recovery.

**Criteria to Monitor the Success of the Pilot Program**

We believe that the most appropriate measures to monitor the success of the pilot program are as follows:

1. Reduction of nutria as measured by catch per unit effort,

2. Estimates of abundance, trapping mortality rate, and the percentage of nutria removed through joint analyses of capture-recapture and telemetry data,

3. Post-trapping presence of nutria through indices of field sign and video monitoring at baited sites, and

4. Aerial surveillance.

As part of our public education activities, we plan to communicate milestones in the program to legislators, interest groups, and the general public through the media and briefings . By using news releases, letters to stakeholders, and public information meetings, we will continue to educate and inform the public about the progress of the nutria control program and wetland restoration.

**Research Program**

To measure the effectiveness of the control techniques and strategies, we propose that 4 graduate students conduct the research projects outlined below during the pilot program. We believe, as Dr. Gosling stated in his 1994 report, that additional information on nutria movements, behavior, and habitat use, is needed to effectively control nutria in Maryland. Graduate students may receive logistical support (use of vehicles, boats, computers and office space) for this research through the Maryland Cooperative Fish and Wildlife Research Unit.

1. Radio-collar 75 nutria in each of the treatment areas (Transquaking/Chicamacomico Rivers and Little Blackwater River/Blackwater NWR) and 50 in the control area (Fishing Bay) (total marked=200 animals). These animals will be tracked year-round to determine daily and seasonal movements, habitat use, behavior, reproductive habits, and responses to various levels of trapping pressure.

2. Mark 500 nutria (ear tags/toe tags) in each of the treatment areas and in each of the control areas (total marked=1,500 animals). All nutria should be marked prior to the implementation of the trapping program. Using mark/recapture data we will develop density estimates to compare the nutria populations in the treatment and control areas and to assess the impacts of the trapping efforts. In addition, we will develop estimates of abundance, survival, and mortality to aid in measuring the success of the pilot program.

3. Compare and evaluate the effectiveness of a variety of trapping techniques and strategies in terms of reducing nutria populations in different habitats. We will analyze the impacts of different techniques on non-target species. The results of this research will provide useful information for the subsequent removal of nutria throughout Maryland.

4. Compare the fecundity of nutria in the treatment and control areas using placental scars and carcass characteristics. Nutria may increase their reproductive activity in response to intensive trapping pressures and we will analyze the differences between exploited and unexploited populations.

Due to the level of field work, we propose that each graduate student be supported by one field technician. In addition, we believe that the majority of animals should be marked with tags or radio-collars prior to implementation of the intensive trapping program. Trapping and research teams should work together to mark all nutria at the beginning of the pilot program for several reasons. First, this will provide an opportunity for trappers, students, and technicians to gain experience and knowledge in trapping and handling nutria in various habitats. Second, it will provide adequate personnel to process a large number of animals in a relatively short amount of time. Third, it may encourage a spirit of cooperation between the trapping and research teams.

In addition, we believe the current research projects that are on-going at Blackwater National Wildlife Refuge and Tudor Farms should continue. These projects include:

1. Exclosure study at Blackwater NWR by Mr. Mike Haramis to determine the impact of nutria foraging activity on marsh vegetation/marsh loss. This project is currently scheduled for completion in 1999, but we suggest that it be extended through the end of the pilot program.

2. Preliminary mark/recapture study at Blackwater NWR conducted by staff will continue until at least the end of the 3-year pilot program. The existing preliminary study will not interfere with the research proposed in the pilot

control program because the proposed study areas are geographically disjunct.

3. Home range and mark/recapture study of nutria at Tudor Farms by Lara Ras, graduate student University of Maryland Eastern Shore. Throughout this project nutria have been trapped/hunted by personnel at Tudor Farms. This project should be completed in late 1998. The research we have proposed for the pilot program would provide a significant expansion of this initial effort and allow for comparison of nutria response to different levels of exploitation.

**Public Awareness and Education**

We propose a small budget to develop public awareness programs to educate the public about the importance of controlling nutria and restoring wetlands within Maryland. We anticipate that such efforts would help minimize the controversy surrounding nutria removal activities. We suggest using a variety of communication tools to cultivate an understanding of the impact nutria are having on Maryland's marshes and sharing this information with schools, media, general public, interest groups, legislators, partner agencies, business groups and landowners.

Our communications tools and strategies would include: holding public information meetings, developing an educational "tool kit" including question and answer sheets, fact sheets, news releases, articles for newsletters, news clippings reprinted with permission, maps and aerial photos of impacted areas, a video, brochure, advisory group membership list, and how to get involved tip sheet. In addition, we would post information on agency Internet sites; provide an interactive display at Blackwater National Wildlife Refuge (NWR); provide briefings for key audiences and stakeholders; host site visits at Blackwater NWR; and develop press kits. We propose holding a kick-off event at Blackwater NWR and continuing to offer stories to the media at strategic times throughout the pilot program. We plan to offer articles in partner agency newsletters; and make the educational video and other tools available for employees and agency customers.

**Reward Incentives**

Past experience has shown that data are lost when marked (tagged or radio-collared) animals are omitted from the data base either because a hunter/trapper captures an animal and does not report the data or because the animal dies of natural causes and is not located by biologists in the field. To minimize the loss of data, we propose a small reward to serve as an incentive to hunters, trappers and the general public to return marked animals that may be recovered outside the pilot study areas. We believe this reward program would also help educate the public about the importance of the

pilot control program and increase awareness about the impacts nutria have on marsh ecosystems. We propose that an award of $5 be given for each tagged nutria and $10 for each radio-collared nutria that is returned. We anticipate that only a small fraction of the total marked animals would be found by other trappers, hunters, or the general public so we suggest this reward for 10 percent of the total marked animals.

The rewards will be promoted in our public education materials and in the media to encourage the return of tags and radio-collars. We also think the returns provide an interesting story for public education and that media coverage may help promote returns. This gives us an opportunity to link individuals not involved with the program, yet supportive of the effort, with the overall success of the pilot program. In addition to the reward, we propose giving a promotional item, such as a baseball cap, with a motivational phrase on the front such as "I'm saving Bay wetlands" and "MD Nutria Control" on the back.

**Leasing Private Lands**

Some of the study areas proposed under the pilot control program are private lands. Although we believe the private landowners will generally support our efforts, we anticipate that some owners may feel they are facing a potential loss of income because they will not be able to harvest nutria at the same intensity as they could prior to the pilot program. Therefore, we suggest a small budget to lease private lands for nutria control activities. These leases would help compensate private landowners for any loss of income and would demonstrate the willingness of the Maryland Department of Natural Resources, the U.S. Fish and Wildlife Service, and the Animal and Plant Health Inspection Service to address the concerns of the public in managing natural resources.

Under the National Environmental Policy Act (NEPA), we anticipate having to prepare appropriate NEPA documentation before implementing an intensive nutria control program. Current management efforts at Blackwater National Wildlife Refuge have been conducted under an existing categorical exclusion. However, expanding the trapping effort under the pilot control program may involve preparing additional documentation, public meetings and federal register notices.

**Wetland Restoration Demonstration Project**

Nutria eradication is a vital component to minimize future damage to wetland vegetation and to prevent wetland loss. However, preliminary findings of an ongoing study investigating plant responses to nutria herbivory suggest that aggressive actions are needed to restore wetlands severely damaged by nutria such as eat-out areas (M.

Haramis, pers. comm., Patuxent Wildlife Research Center). We propose a wetland restoration demonstration project as part of our pilot program. The goals of this demonstration project are to identify, develop and demonstrate methods to restore marsh.

Mash loss along the Blackwater River has been the result of several factors including submergence (long-term increase in water levels due to land subsidence and sea level rise) (Stevenson and Kearney 1996). Nutria foraging activity further exacerbates marsh loss under increased flooding stress because grazed plants are more likely to die when inundated (Baldwin and Mendelssohn 1998) and to exhibit poor germination and vegetative growth (Galinato and van der Valk 1986, Baldwin et al. 1996). These contributing factors are consistent with the pattern of marsh loss in Dorchester County; open marsh first appears as holes in contiguous marsh, then enlarge and persist (Stevenson et al. 1985).

Rising water levels are a primary threat to emergent vegetation in the Blackwater Basin. Restoration must therefore focus on methods to elevate the marsh. Two techniques of sediment augmentation are: 1) fill in or "grout" nutria swim canals and eat-out areas to raise the deteriorated marsh surface up to the vegetative surface of the marsh; and 2) raise the general elevation of the marsh surface using broad sediment application.

Researchers in Louisiana found that thin-layer deposition was effective in increasing elevation of the marsh surface and promoting vegetative growth of cordgrass (*Spartina alterniflora*) in areas formerly too low to support growth (Ford et al. 1998). We suggest that thin-layering may be useful in restoring marsh in Dorcester County (Blackwater National Wildlife Refuge and Tudor Farms).

We propose a factorial arrangement of treatments in a split-plot design with elevation and planting of wetland vegetation serving as the wholeplot effects and herbivore grazing as the subplot effect. This factorial arrangement of treatments will allow us to quantify the interactions among various factors. For example, does adding sediment produce the same effect if nutria are present and the area has been planted in native vegetation.

Experimental areas will be randomly established in Blackwater NWR and Tudor Farms in deteriorated marsh, in or near areas that contain some emergent vegetation.

Each experimental area will receive all combinations of the following treatments, replicated 5 times:

Elevation:

1. no sediment applied
2. 1-2 inches applied with thin layering
3. 3-4 inches applied with thin layering

Planting:

1. no planting
2. planting with Olney's three-square (*Scripus americanus*)

Nutria Grazing:

1. unfenced (nutria have access)
2. fenced to exclude nutria

Growth, coverage, and quantity of vegetation in each plot will be measured monthly during the growing season for 3 years. Measurements such as stem density, height, coverage, leaf area index, and standing biomass will be recorded. Environmental parameters such as salinity, soil redox potential, and canopy light penetration will be monitored. This information will be directly applicable to designing large-scale wetland restoration projects in other wetland areas damaged by nutria.

**In-Kind Contributions from Partnerships**

Removing nutria from the State of Maryland and restoring wetlands presents a major challenge. However, by working together cooperatively with state, federal and private partners, we will have a greater chance of success in meeting this challenge. The following agencies have offered to contribute in-kind services from their existing resources to address the nutria situation and thereby help reduce the overall budget request for this program.

The U.S. Fish and Wildlife Service, including the Chesapeake Bay Field Office and the Blackwater National Wildlife Refuge (NWR), will help by providing equipment including an office building/workshop for the trappers and researchers, 3 boats and trailers, 2 canoes, use of the boathouse, and a computer and printer. Blackwater NWR will devote 20% of the outdoor recreation planner (ORP) position and the Chesapeake Bay Field Office will devote one boat and trailer and 15% of outreach staff time to the nutria project to assist with public education. The ORP and outreach staff will prepare news releases, fact sheets, leaflets, and exhibits to educate the public about the nutria project and its progress. Preparation of NEPA documentation will be provided. Proceeds from the "expense of sales" project will help cover the costs of the

reward incentives and leasing of private lands. In addition, the cost of utilities, telephones, copying, faxing, and related office expenses at field locations will be provided by the Fish and Wildlife Service.

The Maryland Cooperative Fish and Wildlife Research Unit will also help provide equipment including 2 boats, motors, and trailers, computers and printers, video cameras and photographic equipment, and vehicles for graduate students and technicians. Twenty percent of the time of the Assistant Unit Leader for wildlife research will be devoted to nutria research. By funding this work through a research work order (RWO), 45% of the regular administrative overhead charged on salaries may be saved. In addition, the cost of utilities, telephones, copying, faxing, office space and related expenses at the research facility will be covered by the University of Maryland Eastern Shore.

The Maryland Department of Natural Resources will provide equipment in terms of 2 boats and trailers. In addition, 20% of the time of the Furbearer Project Leader and 20% of staff time from the Public Communications Office will be devoted to the nutria project.

Tudor Farms, a privately-owned facility, will provide year-round housing for a full-time graduate student and temporary housing for 10-12 Americorps employees. Tudor Farms will cover the costs of mobilization and demobilization for the thin-layer deposition dredging portion of the wetland restoration demonstration project. In addition, in years 2 and 3, Tudor Farms will cover the costs of a graduate student and laboratory analyses for the wetland restoration demonstration project. Tudor Farms will provide information on previous research and control efforts with nutria, logistical support and access to its private lands.

Ducks Unlimited will cover the travel costs and part of the hourly labor costs for the wetland restoration demonstration project. Ducks Unlimited will provide logistical support for efforts aimed at restoring Maryland's wetlands.

The University of Maryland will cover partial salary costs for the assistant professor conducting the wetland demonstration project and will offer a reduced overhead rate as an additional savings. The University of Maryland (College Park and Eastern Shore campuses) will provide office space and logistical support for graduate students associated with the nutria pilot program.

**Detailed Budget for the Pilot Nutria Control Program**

| ITEM | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| **SALARIES** | | | | |
| Trappers 12 @ $25,000 each | 300,000 | 310,500 | 321,400 | 931,900 |
| Trapper Benefits @ 25% salary | 105,000 | 108,700 | 112,500 | 326,200 |
| Field Supervisor | 31,900 | 33,100 | 34,300 | 99,300 |
| Supervisor Benefits | 11,200 | 11,600 | 12,000 | 34,800 |
| Biologist | 35,000 | 35,000 | 35,000 | 105,000 |
| Biologist Benefits | 8,750 | 8,750 | 8,750 | 26,250 |
| Graduate Assistantships | | | | |
| 4 @ $20,000 each | 80,000 | 80,000 | 80,000 | 240,000 |
| Wildlife Technicians | | | | |
| 4 @ $16,000 each | 64,000 | 64,000 | 64,000 | 192,000 |
| **Salaries Subtotal** | $635,850 | 651,650 | 667,950 | 1,955,450 |
| **EQUIPMENT** | | | | |
| 6 Boats/Motors/Trailers | | | | |
| @ $7,000 each | 42,000 | --- | --- | 42,000 |
| 4 Boat motors @ 2,500 each | 10,000 | --- | --- | 10,000 |
| Annual Boat Maintenance | 2,000 | 2,000 | 2,000 | 6,000 |
| 3 Canoes @ $300 each | 900 | --- | --- | 900 |
| $20,000 Vehicle x 6 teams | 120,000 | --- | --- | 120,000 |
| $20,000 Vehicle for field supervisor | | | | |
| and 1 biologist | 40,000 | --- | --- | 40,000 |
| Annual Vehicle Maintenance | 3,000 | 3,000 | 3,000 | 9,000 |
| Fuel for vehicles and boats for trap | | | | |
| and research teams | 25,000 | 25,000 | 25,000 | 75,000 |
| 200 radio-collars @ $200 each | 40,000 | --- | --- | 40,000 |
| 4 receivers/antenna @ $2,500 each | 20,000 | --- | --- | 20,000 |
| Tags and associated gear | 500 | --- | --- | 500 |
| Fixed-wing Aircraft Time | | | | |
| @$70/hr. for 250 hrs. | 17,500 | 17,500 | 17,500 | 52,500 |
| Control, safety equip. & gear | 82,010 | 8,000 | 8,000 | 98,010 |
| Miscellaneous expenses | 3,000 | 3,000 | 3,000 | 9,000 |
| **Equipment Subtotal** | $405,910 | 58,500 | 58,500 | 522,910 |

**Detailed Budget (continued)**

| ITEM | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| **SUPPLIES** | | | | |
| Video tapes, film and processing | 1,500 | 1,500 | 1,500 | 4,500 |
| Printing Reports | 500 | 1,500 | 1,500 | 3,500 |
| Misc. Office supplies | 750 | 750 | 750 | 2,250 |
| **Supplies Subtotal** | 2,750 | 3,750 | 3,750 | 10,250 |
| **PUBLIC EDUCATION** | | | | |
| Citizen's Advisory Group | 1,000 | 1,000 | 1,000 | 3,000 |
| Public Information Meetings | 1,000 | 1,000 | 1,000 | 3,000 |
| Educational Tool Kits | 3,500 | 1,500 | 1,500 | 6,500 |
| Videos | 20,000 | 5,000 | 5,000 | 30,000 |
| Exhibit upgrades | 5,000 | 2,000 | 2,000 | 9,000 |
| Press Kits | 1,000 | 1,000 | 1,000 | 3,000 |
| Press Events | 1,000 | 1,000 | 1,000 | 3,000 |
| Maryland Outdoors | 1,000 | --- | --- | 1,000 |
| Baseball Cap Incentive | 1,500 | --- | --- | 1,500 |
| **Public Ed. Subtotal** | 35,000 | 12,500 | 12,500 | 60,000 |
| **WETLAND RESTORATION** | | | | |
| Dredging ($1,000/acre) | 20,000 | --- | --- | 20,000 |
| PI summer salary/benefits | 14,083 | 14,505 | 14,940 | 43,528 |
| Graduate Assistant | 20,000 | --- | --- | 20,000 |
| Hourly Labor | 18,650 | 4,250 | 4,250 | 30,150 |
| Wetland Plants | 115,000 | --- | --- | 115,000 |
| Exclosure fencing | 30,000 | --- | --- | 30,000 |
| Field meters | 2,150 | --- | --- | 2,150 |
| Misc. field and lab supplies | 2,500 | 2,500 | 2,500 | 7,500 |
| Publication Costs | --- | 500 | 500 | 1,000 |
| Communications | 600 | 600 | 600 | 1,800 |
| Laboratory Analyses | 8,400 | --- | --- | 8,400 |
| Total Direct Costs | 231,383 | 22,355 | 22,790 | 279,528 |
| Overhead @ 15% | 34,707 | 3,353 | 3,418 | 41,478 |
| **Wetlands Subtotal** | 266,090 | 25,708 | 26,208 | 321,006 |

**Detailed Budget (continued)**

| | | | | |
|---|---|---|---|---|
| Con't Exclosure Study | 5,000 | 5,000 | 5,000 | 15,000 |
| **Exclosure Subtotal** | 5,000 | 5,000 | 5,000 | 15,000 |
| **ANNUAL REQUESTS** | 1,350,600 | 757,108 | 773,908 | |
| **TOTAL 3-YEAR BUDGET REQUEST** | | | | **$2,884,616** |

***IN-KIND CONTRIBUTIONS FROM PARTNERSHIPS***

**U.S. Fish and Wildlife Service**

| | | | | |
|---|---|---|---|---|
| *Blackwater National Wildlife Refuge* | | | | |
| 2 Boats and trailers @ 4,500 each | 9,000 | --- | --- | 9,000 |
| 2 canoes @ $400 each | 800 | | | 800 |
| Pre-fab Facility for offices/storage of equipment/gear for trappers | 55,000 | --- | --- | 55,000 |
| Utilities for Offices | 2,500 | 2,500 | 2,500 | 7,500 |
| Telephones | 5,000 | 5,000 | 5,000 | 15,000 |
| Computer and printer | 3,000 | --- | --- | 3,000 |
| NEPA documentation | 25,000 | --- | --- | 25,000 |
| Outdoor Recreation Planner @ 20% of Time/Salary | 6,000 | 6,000 | 6,000 | 18,000 |
| Reward incentives | 1,750 | 1,750 | 1,750 | 5,250 |
| Leases for Private Lands | 5,000 | 5,000 | 5,000 | 15,000 |
| *Chesapeake Bay Field Office* | | | | |
| 1 Boat and trailer @ 4,500 each | 4,500 | | | 4,500 |
| Outreach Staff @ 15% of salary | 7,000 | 7,000 | 7,000 | 21,000 |
| **Subtotal FWS** | 124,550 | 27,250 | 27,250 | 179,050 |

**Detailed Budget (continued)**

***IN-KIND CONTRIBUTIONS FROM PARTNERSHIPS (continued)***

| ITEM | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| **Maryland Cooperative Fish and Wildlife Research Unit (USGS)** | | | | |
| 2 Boats, motors and trailers @ $7,000 each | 14,000 | --- | --- | 14,000 |
| Utilities for Offices | 2,500 | 2,500 | 2,500 | 7,500 |
| Telephones | 5,000 | 5,000 | 5,000 | 15,000 |
| Computer and printer | 3,000 | --- | --- | 3,000 |
| Video cameras | 3,000 | --- | --- | 3,000 |
| Vehicles for graduate students and field technicians | 15,000 | 15,000 | 15,000 | 45,000 |
| Overhead savings via RWO: Grad. Stud./technicians @ 45% of salary | 64,800 | 64,800 | 64,800 | 194,400 |
| Wildlife Biologist @ 20% of Time/Salary | 9,000 | 9,000 | 9,000 | 27,000 |
| **Subtotal MD Coop** | 116,300 | 96,300 | 96,300 | 308,900 |
| **Maryland Department of Natural Resources** | | | | |
| 2 Boats and trailers @ 4,500 each | 9,000 | --- | --- | 9,000 |
| Public Communications Office @ 20% of Time/Salary | 40,000 | 40,000 | 40,000 | 120,000 |
| Furbearer Project Leader @ 20% of Time/Salary | 12,000 | 12,000 | 12,000 | 36,000 |
| **Subtotal MD DNR** | 61,000 | 52,000 | 52,000 | 165,000 |
| **Tudor Farms** | | | | |
| Thin-layer mobilization | 50,000 | | | 50,000 |
| Graduate Assistantship | | 25,000 | 25,000 | 50,000 |
| Wetland Analyses | | 25,000 | 25,000 | 50,000 |
| Housing for Americorps | 10,000 | 10,000 | 10,000 | 30,000 |
| Housing for graduate student | 3,600 | 3,600 | 3,600 | 10,800 |
| **Subtotal Tudor** | 63,600 | 63,600 | 63,600 | 190,800 |

**Detailed Budget (continued)**

***IN-KIND CONTRIBUTIONS FROM PARTNERSHIPS (continued)***

| ITEM | Year 1 | Year 2 | Year 3 | Total |
|---|---|---|---|---|
| **Ducks Unlimited** | | | | |
| Wetland Demo. Travel and Hourly Workers | 5,000 | 5,000 | 5,000 | 15,000 |
| **University of Maryland** | | | | |
| 20% of Biologist Salary | 14,510 | 14,510 | 14,510 | 43,530 |
| **TOTAL IN-KIND SERVICES** | 384,960 | 258,660 | 258,660 | 902,280 |

**BUDGET SUMMARY**

| | | | | |
|---|---|---|---|---|
| Budget Request | 1,350,600 | 757,108 | 773,908 | 2,884,616 |
| In-Kind Contributions | 384,960 | 258,660 | 258,660 | 902,280 |
| Total Program | 1,735,560 | 1,015,768 | 1,032,568 | 3,786,896 |

LITERATURE CITED

Baldwin, A. H., K. L. McKee, I. A. Mendelssohn. 1996. The influence of vegetation, salinity, and inundation on seed banks of oligohaline coastal marshes. Adv. Bot. Res. 83:470-479.

Baldwin, A. H., I. A. Mendelssohn. 1998. Effects of salinity and water level on coastal marshes: an experimental test of disturbance as a catalyst for vegetation change. Aquat. Bot. 1250:1-14.

Berggren, T. S. and J. T. Lieberman. 1977. Relative contribution of Hudson, Chesapeake, and Roanoke striped bass, *Morone saxatilis*, to the Atlantic coast fishery. Fish. Bull. 76(2): 335-345.

Brown, L. N. 1975. Ecological relationships and breeding of the nutria (Myocastor coypus) in the Tampa, Florida area. J. Mamm. 56:928-930.

Chesapeake Bay Program. 1990. Chesapeake Bay waterfowl policy and management plan: an agreement commitment report from the Chesapeake Executive Council. U.S. Environmental Protection Agency. 71pp.

Dean, R. G. 1979. Effects of vegetation on shoreline erosional processes. Pages 415-426 *In* P. E. Greeson et al. (eds.) Wetland functions and values: the state of our understanding. Am. Water Resources Assoc., Minneapolis, MN.

Ford, M. A., D. R. Cahoon, J. C. Lynch. 1998. Restoring marsh elevation in a rapidly-subsiding salt marsh by thin-layer deposition of dredge material. Ecological Engineering (in press).

Galinato, M. I., A. G. van der Valk. 1986. Seed germination traits of annuals and emergents recruited during drawdowns in the Delta Marsh, Manitoba, Canada. Aquat. Bot. 26:89-102.

Goodger, T. E. 1985. The contribution of wetlands to estuarine production and fisheries: an overview with emphasis on Chesapeake Bay. Pages 121-128 *In* H. A. Groman et al. (eds.). Wetlands of the Chesapeake: Proceedings. April 9-11. Easton, MD.

Hess, I. D., W. Conner, and J. Visser. 1997. Nutria - another threat to Louisiana's vanishing coastal wetlands. Aquatic Nuisance Species Digest, March 1997, vol. 2.

Holliday, M. C. and B. K. O'Bannon. 1995. Fisheries of the United States, 1995. National Marine Fisheries Service, U.S. Department of Commerce. U.S. Government Printing Office, Washington, D.C. 103pp.

LeBlanc, D. 1994. Nutria. Animal and Plant Health Inspection service. Animal Damage Control, Port Allen, Louisiana, B71-B80.

Lowery, G. H., Jr. 1974. The mammals of Louisiana and its adjacent water. Louisiana State Univ. Press, Baton Rouge, LA. 565pp.

Maryland Department of Natural Resources. 1997. Maryland game program: annual report 1996-1997. Annapolis, MD. 40pp.

Metzgar, R. G. 1973. Wetlands in Maryland. Publication 157. Maryland Department of Natural Resources. Annapolis, MD. 229pp.

Nowak, R. M. 1991. Walker's mammal's of the world. Fifth edition. Johns Hopkins University Press, Baltimore, MD. 1,629pp.

Stevenson, J. C., M. S. Kearney. 1996. Shoreline dynamics on the windward and leeward shores of a large temperate estuary. In: Nordstrom, K. F., C. T. Roman (eds.) Estuarine shores: evolution, environments and human alterations. John Wiley & Sons Ltd.

_____, _____, E. C. Pendleton. 1985. Sedimentation and erosion in a Chesapeake Bay brackish marsh system. Mar. Geo. 67:213-235.

Southwick Associates. 1995. The economic contributions of bird and waterfowl recreation in the United States during 1991. Arlington, VA. 36pp.

Tiner, R. W. and D. G. Burke. 1995. Wetlands of Maryland. U.S. Fish and Wildlife Service, Hadley, MA. 193pp.

U.S. Fish and Wildlife Service. 1995. Summary of wildlife restoration activities for 1994: Federal Aid Program. U.S. Government Printing Office, Washington, D.C. 49pp.

Willner, G. R., J. A. Chapman, and D. Pursley. 1979. Reproduction, physiological responses, food habits, and abundance of nutria on Maryland marshes. Wildl. Monogr., no.65. 43pp.

Table 1. TIMELINE FOR NUTRIA PILOT CONTROL PROGRAM

| YEAR 1 | YEAR 2 | YEAR 3 |
|---|---|---|
| ***Public Education*** | | |
| Hold briefings for legislators, interest groups, landowners, and key audiences | continues | provide recommendations |
| Develop educational tool kits | increase distribution | provide recommendations |
| Develop press kits/hold press events | continues | provide recommendations |
| Hold public information meetings | continues | provide recommendations |
| Host informative tours at study sites | continues | continues |
| Establish Internet sites | updates | provide recommendations |
| Issue Public Service Announcements | updates | provide recommendation |
| Establish nutria display at Blackwater NWR | updates | include recommendations |
| Produce video | increase distribution | revise/include recommendations |
| Outdoors Maryland segment | updates | new segment-progress/next step |
| ***Management and Research*** | | |
| Continue nutria exclosure study | continues | analyze results/recommendations |
| Capture and mark/radio-collar nutria | | |
| Initiate intensive trapping | continues | analyze results/recommendations |
| Research home range and behavior | continues | analyze results/recommendations |
| Develop population estimates using mark/recapture data | continues | analyze results/recommendations |
| Compare different trapping techniques | continues | analyze results/recommendations |
| Compare reproductive response of nutria in exploited/unexploited areas | continues | analyze results/recommendations |
| Wetland Demonstration Project | continues | analyze results/recommendations |

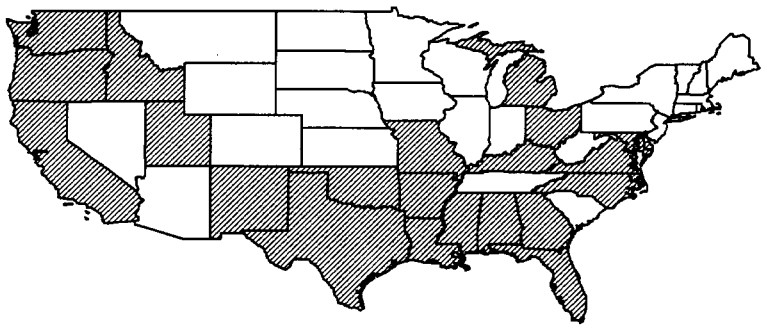


Figure 1. Twenty-two states where nutria have been introduced for fur farming and where feral populations have been established (Alabama, Arkansas, California, Delaware, Florida, Georgia, Idaho, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, Oklahoma, New Mexico, North Carolina, Ohio, Oregon, Texas, Utah, Virginia, and Washington) (Willner et al. 1979, LeBlanc 1994, Hess et al. 1997).

Figure 2. Location of study areas for the nutria pilot program, Dorchester County, Maryland.


**Treatment Areas**
Intensive Trapping and Research

1 - Transquaking/Chicamacomico (Incl. Tudor Farms)
2 - Little Blackwater River/BLK NWR

**Reference Area**
(Research Only)

3 - Head of Fishing Bay (Transquaking/BLK River)

# Extinction to order

**Human beings have proved that they are very good at wiping out other animals without meaning to. The case of the coypu shows how hard it is to do it when you want to**

Morris Gosling

*Legacy of fashion: the coypu lingered long after the fad for its fur*

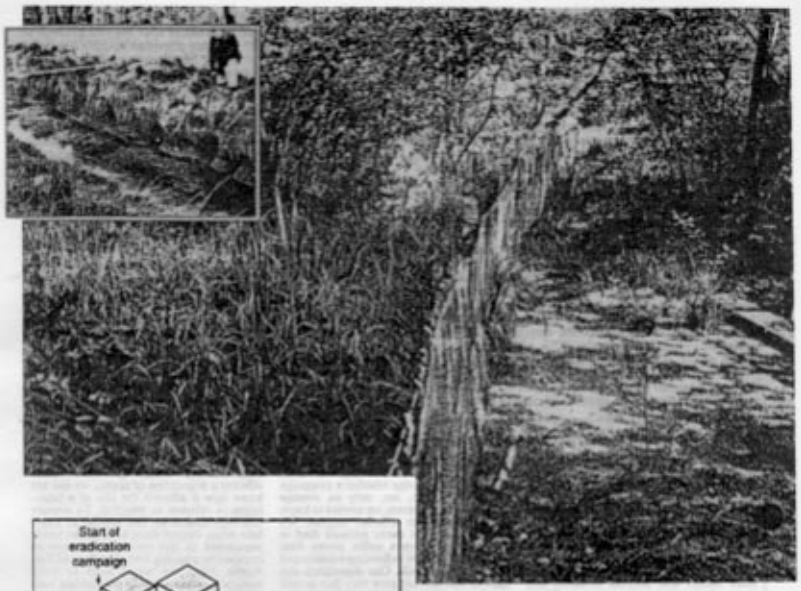
AFTER half a century as an unwelcome guest in the wetlands of eastern England, coypus may at last be extinct in Britain. In January, the Ministry of Agriculture announced that the Coypu Control Organisation had done itself out of a job. The success of the campaign to rid Eastern England of coypus was the result not simply of hard work by a dedicated team of trappers, but also of a strategy based on sound scientific principles.

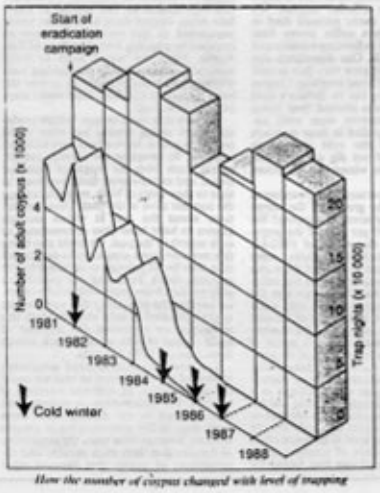
Most research into ways to control vertebrate pests consists of a hunt for new and better techniques. These may be new traps or poisons, or devices to scare pests away from a valuable crop. Once a technique is proven in the laboratory and in carefully controlled field trials, it is ready to market. But the designer of a new device or poison rarely thinks about how the "consumer", the farmer, say, will use it or about its overall effect on the population of the pest. Strategic objectives, such as reducing the population to a specific size or reducing the amount of damage within a specified time and at a specified cost, are almost unknown.

The campaign against the coypu was a rare exception, in which strategic planning was an essential part of the exercise. Such planning was possible only because long-term research on population ecology enabled researchers to predict, within limits, the outcome of particular strategies. This research, which included studies of alternative control strategies, showed that there was a good chance of eradicating coypus from Britain. It also allowed the Coypu Control Organisation to plan how long the campaign would take and how much it would cost. Equally important, biologists guided and monitored the progress of the campaign and designed the criteria for judging when it should end.

The coypu first came to Britain to satisfy the demand for "nutria", a fashionable fur in the 1920s. Nutria is Spanish for otter, but the animal providing its skin for fashion was a rodent native to South America, the coypu. As demand increased, fur farms sprang up throughout the world. Many of these farms, including some of the 50 or so established in Britain in the 1930s, were ramshackle affairs and many animals escaped.

Coypus are semi-aquatic animals and in the wetlands of Norfolk they found a habitat similar to their native swamps. They started to breed and as their numbers increased they began to cause serious damage to agriculture and to the environment. Coypus are large for rodents, weighing as much as 8 kilograms, and their burrows are correspondingly large. Their tunnelling into the banks of ditches and rivers caused particular concern in low-lying East Anglia. At the same time, the coypus ate their way through an assortment of crops: sugar beet, brassicas and cereals were favourites. They also ate a wide range of native wetland plants; some, such as the flowering rush, *Butomus umbellatus*, and cowbane, *Cicuta virosa*, became extremely rare when the numbers of coypu






*How the number of coypus changed with level of trapping*

*Rodent vandals: coypus devasted large areas of reedswamp. Here, coypus are free to the right of the fence but are excluded to the left. In their heyday in the 1960s, coypu tunnels riddled the banks and dykes of East Anglia*

reached a maximum of around 200 000 in the late 1950s. Worse still, coypus devastated large areas of the reed swamp that fringed many of the broads and rivers. Farmers, river boards (the forerunners of the water authorities) and conservationists lobbied for government action. In 1962 the Ministry of Agriculture launched a three-year campaign to trap coypus. Its goal was to reduce the population drastically within two or three years and to confine the survivors to the Norfolk Broads.

At the time it must have seemed an extraordinary stroke of luck when the first winter of the campaign proved to be the coldest for more than two centuries. About 90 per cent of the coypus perished and many of the outlying colonies disappeared. The cold seemed to accomplish most of the campaign's objectives. But, in the remaining years, up to 1965, the population declined only slowly, and when the campaign finished there were still perhaps 5000 animals in east Norfolk. In retrospect, the winter of 1962 to 1963 was the worst thing that could have happened. Although so many coypus died, the winter removed the opportunity, and the need, for any real understanding of how the population responded to trapping. We did not know how much of the reduction in numbers was the result of the cold and how

much of trapping. At the end of the campaign, no one knew how many trappers would have been needed to achieve the same result if the winters had been mild, or how many would be needed to prevent the population from expanding again.

In the event, when the campaign ended, a team of five trappers was given the job of preventing further problems with coypus. With the wisdom of hindsight, we know that a team of this size could not possibly prevent a population irruption when conditions were good for the coypus. This did not become apparent immediately because the coypus suffered a run of bad years, including several cold winters. But luck does not last indefinitely and 1970 was the first of a series of mild winters. The number of coypus began to double each year. More intensive trapping slowed the increase but could not stop it: by 1975 there were about 19 000 animals.

We know about these events in some detail because scientists based at the Coypu Research Laboratory in Norwich have spent almost two decades studying the population ecology of the coypu. The Ministry of Agriculture set up the Coypu Research Laboratory in 1962 to carry out research in support of the control programme. Research on population ecology began in 1970 and as the number of coypus began to multiply we started to understand some of the crucial relationships between trapping effort and the number of coypus. In the early 1970s, only a few years after the end of the campaign, the government was reluctant to spend more money on trapping. In the meantime, the control effort was financed from year-to-year and trapping increased in small amounts as the number of coypus increased. The trappers were employed by Coypu Control, an organisation set up by the Ministry of Agriculture after the end of the first trapping campaign. The ministry provided half the funds for Coypu Control; local drainage boards provided the rest. By 1973, Coypu Control had increased its team of trappers from 5 to 15. The increase was just enough to prevent another big irruption—with some help from occasional cold winters after 1975. This period gave the researchers at the Coypu Research Laboratory the opportunity to collect information on the population when it was expanding under favourable conditions and to see its response to trapping at several intensities.

One way to try to understand how a population varies in size is to build models that take into account variables such as birth and death rates and allow manipulation of the factors that affect the variables (see Box). With a good model it should be possible to plan a strategy for control that will give predictable results. The key to success, however, is the data you feed into the model: if you want accurate information, you must sample the population—seldom an easy process. With the coypu, however, we had all the data we needed. Because the trappers from Coypu Control trapped each animal live, then shot it when they visited the trap the following day, we had accurate figures for the number of coypu caught—and a large number of animals to study. At postmortem we could measure the most important of the variables needed to understand, and eventually to predict, changes in the size of the population. These included measures of age, fat reserves and elements of female reproductive performance, such as the size of a litter, natural

## How the appliance of science saw off the coypu

THE most important things we needed to know in planning the campaign against the coypu was how many trappers would be needed to eradicate the rodents and how long they would take to do it. The first problem in making a decision of this kind was that trapping was only one of the factors that could reduce the population. Before we could calculate the number of trappers needed, we had to identify the main factors that affected numbers and assess their relative importance. There would be no point in spending money on a campaign if trapping would make only a small dent in the population.

For a long time, we had only circumstantial evidence that trapping reduced the numbers of coypu. In the years before the campaign, many trappers maintained that they cleared a site of coypus before moving on to the next. Although this seemed unlikely, it was very difficult to say how many they had caught and how many remained. One problem is that as trappers make inroads into one population, other animals may move into the vacant space.

The best information we eventually obtained on the direct effect of trapping came from a large field trial in which we tried to remove coypus from a 30-kilometre stretch of the River Yare. This trial covered an area large enough for us to see the effects of immigration. After six years of trapping, coypus had disappeared altogether from the central part of the area and, by tagging the ears of animals outside the area, we showed that the animals we continued to catch around the edge of the area were immigrants. This trial showed clearly that if trappers worked intensely enough and for long enough it was possible to eradicate the coypu.

Although the trial in the Yare Valley was convincing, we noticed that the numbers of coypus fell more quickly in cold winters. So before we could judge whether a campaign would work with, say, only an average number of cold winters, we needed to know how cold weather affected coypus. We already knew that many animals died in cold winters. Coypus suffer severe frost damage to their feet in freezing weather and many lose their tails. Our dissections also showed that animals grew very thin in cold weather, and this affected breeding. Coypus breed continuously, but in Britain's cold winters many females aborted their litters when their fat reserves were used up. Young animals also died in large numbers partly because of the cold and partly because they could not dig up roots and rhizomes, the staple winter diet, in frozen ground.

But just how important is cold weather as a factor limiting the growth of the coypu population in the absence of trapping? We know that about 90 per cent of the population perished in the winter of 1962-63. Many animals, including adults, were found emaciated and dying and there can be no doubt that weather had a big influence on numbers. But that winter was the coldest for 200 years. In most cold years few adults died. The main effect of the cold was on breeding, so influencing the number of animals that joined the adult sector of the population for a few months of the year.

The trial on the River Yare proved that trapping was an effective way to control coypus. But we tested the technique in a limited area and because we could not tell at that stage if an animal was a resident or an immigrant we could not quantify the effect of a particular level of trapping effort (measured in numbers of trappers or in "trap-nights", each of one trap baited for one night) on an entire population. Similarly, although we knew how cold weather affected a population of coypu, we did not know how it affected the size of a population in relation to trapping. To acquire this information we first needed to know how many coypus there were in the whole population so that we could measure its response to trapping over the whole of East Anglia. Next, we would need to build models in which we could manipulate both trapping effort and weather to answer the most important question: How many trappers for how long?

The first step was a census. British predators killed young coypus but none could cope with adults. Most adults were killed by trapping. By sampling the animals caught, ageing them from the weight of their eye lenses, and extrapolating their lives back in time to their dates of birth, we could add up the number alive in the past. Using predictions about the rate at which animals known to have been alive accumulated in each month in the past, we could also bring this reconstruction almost up to date rather than wait for all animals to be killed before counting them. By basing our predictions only on data from years with mild winters, we avoided the possibility that some adults might have died in cold winters. With this technique we estimated the number of adult coypus of both sexes in each month from January 1970 onwards.

The next step was to build simulation models of the population so that we could try out the effect of different numbers of trappers. The information on reproduction that we used in the models came from more than 30 000 postmortems of trapped animals. Average litter sizes, the proportion of females that litter each month, and the proportion of young that become adult

*Frost damage: coypus are poorly suited to British winters and suffer damage to their feet and tails*

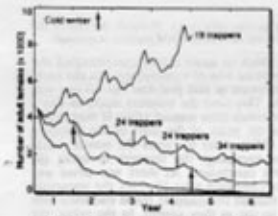
embryo deaths and projected dates of littering.

Slowly, enough information accumulated to census and model changes in the population. The census was essentially a reconstruction of the population in the past using the numbers and ages of the animals killed. For the first time we knew how many coypus were present in the wild and we could measure how they responded both to trapping and to changes in the environment.

We could then start to construct a series of simulation models of the population. After the usual early mistakes, some the result of a lack of information from cold winters, we established some reliable models. Soon we could enter various numbers of trappers into a model and begin to understand the relationships between the effort put into control and the response of the population. This may seem an obvious requirement but, nevertheless it is one that is conspicuously absent from most programmes of control for vertebrate pests. The models suggested that in the worst case—a permanent run of mild winters—about 20 trappers would be enough to keep the population stable, and that a larger force might be able to eradicate the coypu altogether.

Theoretical studies of population dynamics can tell you so much, but investors proposing to spend large sums of money usually need further reassurance that a plan will work. To check whether it was possible to eradicate coypus, the scientists at the Coypu Research Laboratory decided to trap along the River Yare valley from Norwich to Reedham. This stretch of the river, some 30 kilometres long, contains the Yare broads including Surlingham, Rockland and Strumpshaw. These broads and the wetlands around them provide some of the best coypu habitat in East Anglia, making an attempt to eradicate the coypu there a good test. The exercise took six years of hard work by a team of three trappers. The main problem was that as we cleared coypus, more moved in from the surrounding areas, which, at that time, were trapped less effectively. In the centre of the test area, however, the trappers succeeded in removing all the coypus.

each month after birth, were some of the detailed variables that we calculated. From these, we could build a realistic model including the birth rates and the number likely to survive the vulnerable juvenile period. It is dangerous to enter values into models without understanding what they mean and our team devoted a great deal of effort to answering such basic questions as




*Simulated changes in the number of adult females at different levels of trapping. All curves are for continuous mild winters except the dotted line, which includes some cold winters*

why females bred at particular times and why sometimes they abandoned a litter, by abortion for example, or part of a litter, by resorbing individual embryos, and began to invest in the next.

We calculated death rates in the simulation from records of the number of coypus that the trappers of Coypu Control caught in relation to the number of traps they set and the number of coypus that we knew were "available" from the monthly census. All the variables were entered as monthly values and the models run using a series of monthly estimates from the reconstruction of the population. To begin with, the figures for reproduction added to these given values and the figures for mortality subtracted from them. But after a few months the models generated their own adult population and became free-running.

The simulation models enabled us to understand the way that trapping and cold weather combined to reduce the number of coypus. As in the historical census, the models showed a characteristic seasonal cycle in the number of adults. Numbers decreased through the winter to a minimum in May then climbed to a maximum in October. The size of the oscillation seemed to depend mainly on how bad the winter was and how intense the trapping. Reflecting events in the real world, no adults died in the models as a direct result of cold weather, but the number of young animals entering the population was very low at the end of cold winters. Trapping was highly effective at such times because it is easy to find traces of coypus when there is little vegetation to conceal them and they find bait more attractive when there is little else to eat. When the coypus were having little success in breeding, trapping had a large impact. In simulations of events over several years, with enough trappers, the population fell in steps, with the largest decreases in cold winters.

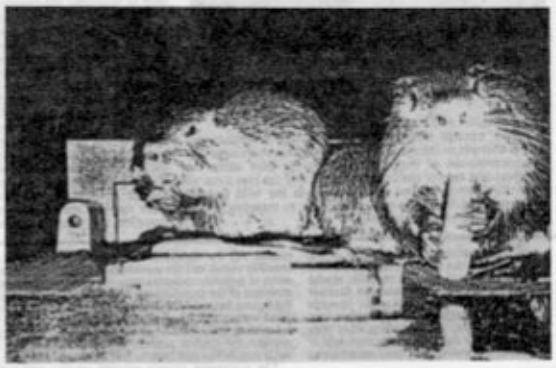
We modelled the impact of cold winters by dividing the information on reproduction and mortality into years following cold or mild winters and entering these into simulations in various combinations. For example, we tested the effect of continuous cold winters and of an average frequency of cold winters. Most important was the effect of continuous mild winters, the "worst case" from the control point of view. We entered a range of intensities of trapping to simulate the likely impact of trapping teams of various sizes. The options given to the Coypu Control Strategy Group when they were trying to decide on a long-term strategy for control included the existing trapping force (19), an enlarged one that would reduce the numbers of coypus steadily with continuous mild winters (24) and a large one (34), which would reduce numbers very quickly. The group chose the force of 24 trappers partly to allow time for further research to find out how to overcome the problem of catching coypus when they were at very low densities.

After the campaign began we continued to monitor the population by monthly censuses and by simulating trends from information from the recent past. Taking into account actual cold winters, the decline in the population was remarkably similar to the simulations. If anything, the decline was faster than expected because of technical improvements during the campaign and the incentive of the bonus.

An unexpected development was that the proportion of females that successfully produced litters began to decline when the population reached a very low density. Careful examination of the structure of the population showed that males had become progressively rarer as the intensity of trapping increased. Long-term observation of social behaviour showed that males tried to defend a number of females; to do this they had to travel further and faster than the females. This made them more likely to be trapped and so much rarer. At very low density, males probably became so rare that some females could not find mates. So what happened when the coypu became really few and far between increased the chances that the campaign would succeed rather than spoiling its chances as the Coypu Strategy Group had feared. □

Eradication was not just a theoretical possibility, it was a practical option.

These developments came together in 1977 when an independent committee, the Coypu Strategy Group, was set up to consider long-term policy on coypus. Should there be an attempt to eradicate coypus? Should there be a permanent control policy? Or, should organised control be abandoned? The group considered evidence from farmers, water authorities, drainage boards, biologists and conservationists. It also examined the detailed information which by this time was available from the Coypu Research Laboratory, including models simulating the outcome of attempts to control coypus with different numbers of trappers. In the end the committee recommended that an attempt should be made to eradicate coypus in the long term. In the medium term, however, it suggested trapping at a level that would reduce numbers, even over mild winters. The group held back from recommending an immediate attempt at eradication because it was worried about a number of unsolved biological problems. It was particularly concerned about the difficulties of catching coypus when they were at very low densities over the whole of East Anglia.



*Carrots to catch coypus: trappers baited rafts to lure the coypus into cages. Towards the end of the campaign, coypus were hard to find but carrots on baited rafts pinpointed pockets of animals*

After long discussion, not least about funding, the Ministry of Agriculture accepted the committee's recommendations and, in 1980, it announced a new campaign. A reconstituted Coypu Control Organisation employed 24 trappers and 3 supervisors. The ministry provided half of the necessary £2·5 million; the local water authority, Anglian Water, and the Internal Drainage Boards the rest. In the period following the report by the strategy group there were also discussions with the ministry about the technical basis of the new campaign. One of the original problems was that after the first campaign, the trappers were never adequately equipped. With the operation run on a shoestring, they had too few traps and unreliable two-wheel drive vehicles that often bogged down on muddy tracks. But would properly equipped trappers make shorter work of the operation? And could we introduce improved techniques for control quickly enough to help? In short, could we eradicate coypus within, say, 10 years? The laboratory's answer was that there was a good chance of success, given an average number of cold winters.

The final, all-important question was whether the trappers would be prepared to work themselves out of a job. It seemed clear that if we wanted to eradicate coypus there must be a financial incentive which to some extent compensated the trappers for their eventual loss of employment. In the early 1970s, everyone was aware of this problem but no one was prepared to tackle it. This time the trappers stood to win a bonus of up to three times their annual salary if they eradicated coypus within six years of the start of the trapping campaign (1 April 1981). After six years the bonus would gradually decline to encourage the trappers to bring the campaign to an early conclusion. As there was never any intention to fund the campaign after 10 years, the attraction of this scheme was that all the trappers could end their jobs with a capital sum to use as they wished. In the event, the trappers worked hard to earn the maximum bonus.

Although we tested several techniques for control, field trials showed that the existing method of trapping in cages was remarkably effective. It had the advantage that trappers could release moorhens and water voles that sometimes entered the traps, and kill only the coypus. Field experiments also showed that traps were much more effective if set on baited rafts. Researchers at the laboratory made detailed recommendations about how best to deploy the trappers, updating the advice every three months using indices calculated from past information about the distribution of trapping effort and captures.

The Coypu Research Laboratory also had the job of checking that the campaign had worked. This was vitally important, not least because there had to be an independent assessment before the trappers were paid their final bonus and the control organisation disbanded. The problem is that it is

impossible to demonstrate with certainty that something is absent. The coypus in the East Anglian wetlands illustrate this point well. All that we could do was to look as hard as possible for a reasonable time, using baited rafts, some fitted with cameras, as well as field workers doing their utmost to find coypus. In the meantime the trapping force kept up intensive trapping. Financial as well as technical considerations influenced the period of checking and the Ministry of Agriculture finally decided that this phase of the operation would last for 21 months after the last sign of coypu.

### Search for survivors

Has the campaign worked? At the start, in April 1981, there were more than 5000 adult coypus. By April 1986 there were fewer than 40. At this point the problem changed from one of reducing the size of the population to one of finding the last few individuals. This part of the campaign was relatively unpredictable, not least because surviving animals may have been scattered over Norfolk, Suffolk, Lincolnshire and Essex. In the event, the trappers found the last breeding group of coypus on the River Great Ouse, near St Neots, in April 1987. The full team of 24 trappers continued to set traps as before but caught no more coypus. At this stage, many would be tempted to say that all the coypus were dead. However, in the middle of last year, two coypus were killed on roads, one near Barton Bendish in west Norfolk and the other near Peterborough. Both animals proved to be very old males and careful checking showed they were probably isolated individuals. There seemed to be no danger that these animals belonged to breeding groups and they were not worrying enough to affect the planned end of the trapping campaign.

On 10 January 1989, 21 months had passed without any evidence of coypus other than the two elderly males. At this point, as agreed, the campaign ended. There is little likelihood that a viable population of coypus remains but it will be some years before we are absolutely certain. Isolated individuals could survive, so we need to maintain the ability to detect and catch any such animals for a while. The Ministry of Agriculture's field workers, who searched for coypus up to the end of the trapping campaign, will continue to look for any stragglers.

The campaign against coypus in Britain has not been without cost. Coypus are interesting and attractive animals and apart from the expense of the campaign, some aspects of the work, particularly killing animals on this scale, were inevitably unpleasant. Today those people who introduced coypus could be prosecuted, but in 1930 there was no law to prevent such reckless introductions. Local attempts to eradicate an introduced animal should take account of whether it is endangered elsewhere, particularly in its native range. Fortunately, although the coypu's range has shrunk in South America it is still abundant. In Britain some coypus remain in zoos. The law requires that they are held securely, and there is little chance of breakouts on the scale of those in the 1930s.

The coypu campaign is one of the rare successes in reversing an environmental mistake. It succeeded largely because of the investment in applied population biology—which was vital in planning and guiding the campaign. This experience has general significance for the management of other populations of vertebrates. With a few modifications, many of the analytical techniques would suit other schemes for controlling numbers, whether the purpose is to crop the population or even to conserve it. The success of the trapping campaign will also encourage those considering attempts to remove other introduced mammals that are causing unacceptable damage to their adoptive environment. □

Dr Morris Gosling is head of the Mammal Ecology Group in MAFF's Central Science Laboratory.

STATEMENT OF DR. EDWARD C. SOUTIERE, PRESIDENT AND MANAGER, TUDOR FARMS INC.

Tudor Farms is a privately-owned wildlife management area and hunting preserve located on the Transquaking and Chicamacomico River watersheds upstream of the Blackwater River and Fishing Bay marsh complexes. I manage the Farms' 5,500 acres for a variety of wildlife, both upland and wetland species, but managing for waterfowl is our priority. Our 2,400 acres of tidal marsh and 200 acres of man-made freshwater wetlands are important habitat to thousands of ducks, geese and shorebirds. All the tidal marsh upstream and immediately downstream of Tudor Farms is privately owned, and all of this marsh land is either owned by waterfowl hunt clubs, leased to waterfowl hunters by the owners, or hunted on by the owners themselves. Today this Committee is addressing the loss of valuable wetlands at the Blackwater National Wildlife Refuge caused, in part, by the nutria. I welcome this opportunity to remind the Committee that the private owners of wetlands in Dorchester County, Maryland are suffering the same losses and damage, and that we too are interested in finding a solution.

In the nine years that I have managed Tudor Farms, 500 acres of vegetated tidal marsh has converted to mudflats and open water. Marsh loss is greatest, averaging 30 percent to 40 percent, in the broad marsh expanses adjacent to the Transquaking and Chicamacomico Rivers, and less in the narrow headwater marshes of the creeks feeding into the rivers. Early on, my staff and I recognized that nutria were damaging the marsh with their feeding and traveling activities. In addition, nutria feed in our crop fields and landscape plantings, and dig and burrow in our water-control dikes and structures, causing thousands of dollars of damage annually.

Hoping to control, if not reduce, the population of nutria on Tudor Farms, I opened the Farms to trapping by several local fur-trappers in 1992. These trappers were of course most interested in trapping muskrat, raccoon and fox for which there is a fur-market. There is no market for the fur of nutria in Maryland so I gave the trappers a cash incentive of $1.25 for each nutria killed. In 1995, Tudor Farms awarded a research grant to the University of Maryland, Eastern Shore (UMES) to study the nutria on Tudor Farms and to determine what if any effect the trapping was having on the nutria population. The graduate student, Lara Ras, who conducted the research will complete her program of study at UMES this fall.

At this time, I can tell you that the number of nutria trapped or shot each trapping season has remained relatively stable at about 5,000, ranging from 4,000 to 5,000. The estimates of nutria numbers on Tudor Farms have also remained stable at 17,000 to 24,000, or 7 to 10 nutria per acre of marsh. This means that, at best, we have succeeded in removing only 25 percent of the population each year. For nutria, which reach sexual maturity at 6 months of age and can have two or three litters of 4 to 5 young per year, this is no control at all.

I conclude that traditional trapping during the 4 month fur-bearer season in Maryland cannot alone control nutria numbers. Furthermore, the removal of 25 percent of a nutria population each year is insufficient to arrest the loss of vegetated marshland.

Eradication, a much more difficult objective than control, is a desirable goal for Maryland if we are to have any hope of retaining our valuable tidal marshes. But eradication will require the dedicated effort of a professional staff working full-time and year around for several years, and some help from Mother Nature, to achieve. Public support of the eradication effort will be essential for, as Dr. L. M. Gosling noted during his 1994 seminar at Tudor Farms on the subject of the United Kingdom nutria eradication program, in an eradication program "the only nutria you are paying for is the last one."

Tudor Farms will support the pilot project, "Marsh Restoration: Nutria Control in Maryland." We have a vested interest in maintaining a healthy wetland system in the Chesapeake Bay. I believe our neighbors share our interest. I urge this Committee to support the funding request for the proposed pilot project. We clearly need to move quickly to find and develop techniques to save and restore our fast vanishing marshlands.

---

STATEMENT OF RICHARD B. PIERCE, DIRECTOR OF OPERATIONS. DUCKS UNLIMITED, INC.'S GREAT LAKES/ATLANTIC REGIONAL OFFICE

Good afternoon Mr. Chairman and members of the Subcommittee. My name is Richard Pierce, I am the Director of Operations for Ducks Unlimited's Great Lakes/Atlantic Regional Office. My staff and I are responsible for delivering Ducks Unlimited's conservation programs along the Mid-Atlantic Coast. Ducks Unlimited is the largest non-government waterfowl and wetlands conservation organization in

the world, having more than a million supporters. Since its founding in 1937, Ducks Unlimited has raised more than $1 billion to conserve over 8 million acres of critical wildlife habitat in all 50 states, each Canadian province, and in key areas in Mexico.

Since 1987, Ducks Unlimited has worked with state, Federal and private conservation partners to restore, protect, and enhance over 40,000 acres of wetlands and associated habitat within the Chesapeake Bay watershed. In May of 1997, we announced our Chesapeake Bay Initiative, a joint partnership with the Chesapeake Bay Foundation and other partners to restore wildlife habitat on an integrated, landscape approach, and improve water quality by reducing sediment and nutrient loading within the Chesapeake Bay watershed. This Initiative is an ambitious effort to restore over 90,000 acres of wildlife habitat and raise over 20 million dollars to support our conservation efforts, and the efforts of our state and Federal partners. Through this Initiative we have been working with the U.S. Departments of Agriculture and Interior to implement conservation programs, including the Partners for Wildlife Program, Conservation Reserve Enhancement Program, Wetland Reserve Program, and the Wildlife Habitat Incentive Program, to improve wildlife habitat and water quality across the Chesapeake Bay watershed.

The tidal marshes of the Chesapeake Bay provide habitat for over 1 million wintering waterfowl, which accounts for approximately 35 percent of all waterfowl wintering in the Atlantic Flyway. Species of continental importance include American Black ducks *(Anus rubripes),* Canvasback *(Aytha valisineria),* Lesser and Greater Scaup *(Aytha affinis, Aytha marila)* and the Atlantic Population of Canada Geese, *(Branta canadensis).* In addition to waterfowl, the Bay's ecosystem supports over 2,700 species of fish and wildlife.

As you have heard from previous testimony, nutria *(Myocastor coypus),* an introduced exotic species have caused severe damage to the tidal marshes of the Chesapeake Bay. Due to the dependence of large populations of waterfowl and other wildlife on these affected ecosystems, Ducks Unlimited finds that controlling nutria populations and restoring tidal wetlands is a priority for our Chesapeake Bay Initiative.

Impacts to tidal marshes are a result of several factors including sea level rise, land subsidence, erosion, and nutria. Nutria are large herbivores that feed directly on the vegetation that provides structure to a marsh. Their impacts result in changes in the vegetative composition of an emergent marsh, and even the total loss of the marsh to open water. In either case, the vegetative communities are altered and productive waterfowl and wildlife habitat is lost.

Nutria feeding habits create highly erosive conditions and leave the marsh pitted with holes and swim channels, and often void of vegetation. The primary food source for nutria is three square bulrush, *(Scirpus onleyi).* Three square bulrush is also a valuable food resource for wintering waterfowl. The loss of this vegetation component not only effects wintering waterfowl populations, but also leads to a reduction in invertebrate populations, which migrating waterfowl readily depend on. Additionally, increased rates of erosion in concert with rising sea levels increase the hydroperiod, or flooding regime, of the marsh, which limits the ability of three square bulrush and other plants to revegetate a site. The swim channels through the marsh also permit the tidal inundation of many isolated, interior ponds that support submerged aquatic vegetation. The increase in salinity and turbidity limits the growing conditions for submerged aquatic vegetation, and has reduced many interior ponds to barren mud flats. Submerged aquatic vegetation is an important food source for migrating and wintering waterfowl, especially American Black ducks, a species of priority concern in the Atlantic Flyway.

The restoration of tidal wetlands or marshes is an important component of our Chesapeake Bay Initiative. Tidal wetland systems are some of the most productive ecosystems in the world, supporting thousands of aquatic and terrestrial species, including many that are threatened and endangered. Maryland has lost over 73 percent of its original wetlands, making the remaining wetlands vital to maintaining the health of the Chesapeake Bay ecosystem and the over 2 million waterfowl that migrate through or winter in the Chesapeake Bay each year. Unfortunately, large expanses of Maryland's remaining marshes have been degraded by nutria. Therefore, Ducks Unlimited supports this plan and its goal of controlling nutria populations and restoring marsh habitat. We also support the plan's efforts to study alternative restoration techniques in order to minimize cost and increase effectiveness once restoration efforts begin. Controlling nutria is just one step in slowing the rate of marsh loss in the Chesapeake Bay watershed. Restoration projects should also be implemented as soon as possible in order to study restoration techniques and to establish demonstration projects to educate the public on the importance of the restoration of coastal marshes.

Mr. Chairman and members of the Subcommittee, thank you for your time and attention.

---

STATEMENT OF JIM RAPP, DIRECTOR, SALISBURY ZOOLOGICAL PARK

Mr. Chairman, Congressman Gilchrest, and Members of the Committee:

My name is Jim Rapp. I am the Director of the Salisbury Zoological Park in Salisbury, Maryland. I have worked for the Salisbury Zoo for ten years serving in a number of capacities, including the Zoo's Education Director.

The Salisbury Zoo is a twelve-acre facility that displays over 100 different species, over 350 specimens, and specializes in exhibiting North and South American species. The Zoo has been a Member of the American Zoo and Aquarium Association (AZA) since 1972, and has an annual attendance of 250,000 visitors, including 15,000 local school children. The Zoo is also involved in a number of education programs with a sister zoo in Belize and a nature reserve in Mexico.

The Salisbury Zoo appreciates the opportunity to testify before the Committee on the pilot program proposal entitled "Marsh Restoration: Nutria Control in Maryland." The Zoo supports the proposal and expects to be an integral partner in executing its educational mission.

As I am the last speaker today, my comments will focus on the overall impact of introducing nonindigenous species to our Nation's ecosystems, and the importance of educating the public to prevent further destruction of the Eastern Shore Wetlands.

Species introductions, whether intentional or unintentional, seem to be an inevitable result of human activities. They may result in both economic and ecological problems; it has been estimated that over 90 percent of all such introductions have been harmful in some respect. As U.S. Fish and Wildlife Service Director Jamie Clark said, "Invasive species tend be very adaptive, aggressive, and resilient. Once they are established, we are unlikely to ever completely eradicate them." In fact, Mr. Chairman, this past Sunday, the Cable News Network (CNN) aired a new segment from its *Earth Matters* series called "Invader Animals" that illustrated the devastating effects of introduced species on local ecosystems and the high cost associated with controlling or eradicating them.

The United States has been invaded by nonindigenous exotic species since the colonial period. However, in the late 1920s when the United States became home to the sea lamprey and witnessed its reign of terror on lake trout in the Great Lakes, we truly came to realize the destruction these species could cause to local ecosystems and our native species. Since then, it seems our nation has been in a constant state of war to prevent either the spread of established exotic species or the introduction of others. One species in particular, the zebra mussel, illustrates well the economic and ecological dangers of nonindigenous exotic species. The zebra mussel was unintentionally introduced into the Great Lakes ecosystem in the 1980s through the untreated ballast tanks of vessels, and in less than ten years, it has established itself throughout the Great Lakes region, portions of the Mississippi River, the Arkansas River, and Lake Champlain in New York. The zebra mussel has caused millions of dollars in damage to filtration systems throughout these areas, and has smothered populations of native clams, mussels, and crayfish.

In 1990, Congress responded by passing the Aquatic Nuisance Prevention and Control Act. The Act created the Aquatic Nuisance Species Task Force to coordinate Federal and state agencies combating the expanding problems associated with the zebra mussel, as well as other introduced aquatic species. The Task Force is charged with developing and implementing a program to prevent the introduction and dispersal of aquatic nuisance species in U.S. waters, and to monitor, control and study such species.

In addition to the devastation caused by the zebra mussel, other introduced exotic species such as the gypsy moth, pine boring beetle, *Phragmites* reed, and brown tree snake have inflicted damage on various ecosystems and displaced a number of native species. The brown tree snake is a particularly good example of the effects of exotic species on native wildlife.

The brown tree snake was accidentally introduced to Guam in the late 1940s with a shipment of military equipment. In the absence of natural predators, the snake population spread quickly throughout the island. Animals native to Guam, especially birds, lacked the natural adaptations to protect themselves since snakes had never before existed on the island. The result: there are no more native birds in the wild on Guam, including the once-common Guam rail and Micronesian kingfisher. Although brown tree snakes are nocturnal and are rarely seen by people, they have

been known to enter people's homes and farms, killing small pets and farm animals, and even attacking children. Guam's forest is eerily silent.

Now Hawaii, home to more endangered plants and birds than any other U.S. state, may be the brown tree snake's next victim. Without the diligence of the Department of Interior and the state of Hawaii and their extensive inspection program at airports and other transport centers, the brown tree snake might already be established on Hawaii, and Hawaiians would eventually hear the same eerie silence experienced by Guam. The cost associated with this inspection program is understandably high—in the millions—but the alternative is the extinction of hundreds of species.

The AZA has also been active in conserving the endangered species of these islands. Through its Species Survival Plan® (SSP), AZA coordinates a breeding and recovery plan for the Guam rail involving sixteen institutional members, and a plan for the Micronesian kingfisher involving fourteen institutional members. The goal is to someday return these species back to their native habitats. Although there is a tremendous cost associated with these programs, AZA zoos know their involvement is critical because they are the last hope these species have from becoming extinct.

Biologists are familiar with numerous methods to curb the adverse effects of introduced animals and to preserve native ecosystems and species. Complete elimination of the exotic species is sometimes advocated, but it can be a prohibitively expensive technique. Controlling populations at low levels has also been proposed. Ways to carry out these solutions have ranged from live capture of animals to shooting and poisoning.

As the other speakers today have discussed, the State of Maryland, particularly the Eastem Shore, has a serious nutria problem. It also has a growing problem with the mute swan, another introduced species. Currently, Maryland has a mute swan population of 3,000, the largest concentration of any state. The population of the entire eastern seaboard is 10,000 birds. These birds are very aggressive and have displaced a number of local bird populations, especially the threatened black skimmer. Mr. Chairman, as the Committee is well aware, the wetlands of the Chesapeake Bay are some of the most important wetland areas in the United States, and have received global recognition as "Wetlands of International Importance" under the Ramsar Convention Treaty.

Wetlands are among the most productive ecosystems in the world, yet over half of this country's original wetlands have already been destroyed, either by development, erosion, subsidence, or nonindigenous exotic species.

Maryland's wetlands are of tremendous importance to the state's residents. They serve as a place for fishing, hunting, trapping, bird-watching, berry and timber harvesting, agriculture and livestock production, and the growing hobby of wildlife viewing and photography. The Zoo has been an active partner in promoting ecotourism on the Eastern Shore, especially bird-watching, through the Delmarva Birding Weekend and the creation of the Delmarva Birding Guide. The Eastern Shore's wetlands are home to hundreds of species of birds, mammals, fish, and insects, and serve as important spawning or nursery sites for many finfish and shellfish. Moreover, these wetlands are vitally important to over one million waterfowl that either winter on the Bay or use it during their migration. Resource managers fear that, without intervention, Maryland's wetlands, which provide significant ecological, cultural, and economic benefits to the state, may completely disappear within the next one or two decades.

While it is important to continue confronting the threats to Eastern Shore wetlands of development, erosion, and agricultural runoff, dealing with the nutria is perhaps an easier task. As you have already heard from the other witnesses, nutria are prolific, highly invasive, face no natural predators to control their numbers, and threaten the native muskrat. Most importantly, these powerful animals forage directly on the vegetative root mat, leaving the marsh pitted with digging sites and deep canals.

Consequently, several Federal, state, and private organizations—many represented before you—have joined forces to develop a plan for controlling nutria. The goal of the proposal is to develop methods and strategies to eradicate the nutria population, restore marsh habitats, and promote public understanding of the importance of preserving Maryland's wetlands. I believe the Salisbury Zoo is the perfect partner to help execute the latter part of this proposal, because our primary mission is to increase the public's awareness and appreciation of wildlife and its habitat, and to encourage people to become participants in conservation.

The proposed budget to develop a public awareness program is absolutely crucial if the state's residents are to fully understand and thus become active partners in controlling nutria in Maryland. The program will help minimize the controversy

that will most likely surround nutria removal activities. It is important that Eastern Shore citizens realize the significance of the Blackwater National Wildlife Refuge proposal, and understand the potential benefits it can have for Maryland and other states, such as Louisiana. The Salisbury Zoo would be a natural collaborator for the Refuge in disseminating information to the public, and would offer an excellent venue for education programs that target school children. The Zoo sees itself as that bridge, necessary for the program to work, between Federal and state agencies and the public.

This proposed pilot program for eradicating nutria will be extremely beneficial in preventing future species from being added to the Endangered Species Act, especially if the nutria continues its conquest of wetlands habitat. Maryland is fortunate; the current nutria population is still small enough for this program to be successful. We can eradicate the nutria now. However, if we wait much longer, we may only hope to control the nutria's numbers. To use that famous saying, an ounce of prevention is worth a pound of cure, even at the cost of $2.3 million. Weighing the long-term cost of destruction from nutria against the benefits of this pilot program, I believe the answer is clear.

This proposal is a good, practical first step to better understand the scope of the nutria problem in the Blackwater Wildlife Refuge and the entire Eastern Shore, and the best way to eradicate this destructive adversary.

Thank you for allowing me to testify in support of the Proposed Blackwater National Wildlife Refuge Marsh Restoration Program to Control Nutria.

Written testimony to:

**U.S. House of Representatives**
**Committee on Resources**
**Subcommittee on Fisheries Conservation, Wildlife and Oceans**

H1-805 O'Neill House Office Building
Washington, D.C. 20515

Subject:

# WETLAND RESTORATION DEMONSTRATION PROJECT

A component of the proposed pilot program entitled
"Marsh Restoration: Nutria Control in Maryland"

Submitted by:

**Andrew H. Baldwin, Ph.D.**

Assistant Professor
Department of Biological Resources Engineering
University of Maryland
College Park, Maryland

July 16, 1998
2:00 PM

## WETLAND RESTORATION DEMONSTRATION PROJECT

### Background

Nutria eradication is an important component of efforts to reduce damage to wetland vegetation and slow marsh loss. However, preliminary findings of an ongoing study investigating plant responses to nutria herbivory (using fenced exclosures at the Blackwater National Wildlife Refuge, M. Haramis, pers. commun.), suggest that modification of other factors such as sediment elevation are also likely to be important in restoring lost or damaged wetlands. We therefore include a wetland restoration component within the proposed nutria eradication pilot program to investigate the types of procedures and methods most appropriate to restore coastal emergent marshes that are experiencing herbivory by nutria. The goals of this component are to identify, develop, and demonstrate methods to restore damaged marsh and reestablish lost marsh.

We propose to implement the wetland restoration demonstration project in marshes in and nearby Blackwater National Wildlife Refuge on Maryland's eastern shore. Marsh loss along the Blackwater River is the result of a number of interrelated factors, among the most important being flooding stress to marsh vegetation caused by coastal submergence (i.e., the long-term increase in water level relative to the marsh surface due to land subsidence and sea level rise) (Stevenson and Kearney 1996). Nutria foraging activity further exacerbates marsh loss under increased flooding, because grazed plants are more likely to die when inundated (Baldwin and Mendelssohn 1998) as well as to exhibit reduced germination and vegetative growth (Galinato and van der Valk 1986; McKee and Mendelssohn 1989; Baldwin et al. 1996). These contributing mechanisms are consistent with the pattern of marsh loss observed at Blackwater, where open marsh first appears as holes in contiguous marsh, which then enlarge and persist (Stevenson et al. 1985).

Because rising water level is a principal threat to emergent vegetation in the Blackwater basin, restoration must focus on methods to increase the elevation of the marsh surface. The most direct way to increase the elevation of the surface is to increase the influx of sediment to deteriorating marshes, either through diversion of sediment-laden waters or dredging of sediments and placing them in deteriorating areas. Because a suitable source of sediment-laden water is lacking on Maryland's eastern shore, dredging is necessary. However, conventional dredging methods deposit sediments in spoil piles or banks, and cannot easily be applied to increasing the elevation of vegetated and non-vegetated areas.

### Thin-Layer Sediment Deposition

A technique that was recently employed to restore wetlands in the delta of the Mississippi River is the pumping of dredged material through of sprayer so that it is deposited in a thin layer on the marsh surface. This "thin-layer deposition" technique has several features that make it well suited for restoration of Blackwater marshes:

1. *Shallow Draft Capability.* A small dredge can operate in 2 ft of water and a larger dredge in 4 ft of water. This is critical in providing access to the Blackwater River and adjacent shallow marsh areas.

2. *Remote Pumping Access.* Sediment can be pumped through a hose up to 2,500 ft away from the dredge. This feature facilitates restoration in interior marsh areas.

3. *Variable Material Capability.* Both fine-grained mineral and organic material can be handled by the dredge pump and distribution system.

4. *Precision Application.* Dredged material can be applied where desired, allowing for filling in or "grouting" nutria eat out areas within vegetation or in broad spray application to both vegetated and non-vegetated areas.

Researchers in Louisiana recently found that use of thin-layer deposition was effective in increasing elevation of the marsh surface and promoting vegetative growth of cordgrass (*Spartina alterniflora*) into areas formerly too low to support growth (Ford et al. 1998). Like Blackwater, the Louisiana delta plain is experiencing extensive wetland loss due to factors including land subsidence and nutria herbivory (Boesch et al. 1994). The similarity of conditions between Blackwater and Louisiana suggests that deteriorating coastal marshes in Maryland can be restored using thin-layer sediment deposition.

**Factors Controlling the Success of Restoration Efforts**

While it is likely that native plants can be encouraged to grow in denuded areas if sediment elevation is increased, the mechanisms of colonization of such large areas are not well understood. To improve our understanding and to promote the desired restoration of native plants, the Wetland Restoration Demonstration Project will incorporate an experiment to investigate the effects of various treatment and environmental factors on wetland restoration success. Achieving the correct sediment elevation is one of the most important factors in restoring deteriorating wetlands. An additional concern in any restoration effort is colonization of restored areas by invasive species such as *Phragmites australis*, which may inhibit colonization by native marsh species; planting of native species may reduce *Phragmites* colonization. And finally, nutria grazing may reduce colonization and growth of wetland vegetation in restored areas.

Since marsh deterioration is not limited Blackwater National Wildlife Refuge, and is affecting private as well as public landowners, we plan to implement portions of the Wetland Restoration Demonstration Project on Tudor Farms' property as well as within the refuge itself. At these locations we propose to conduct a field experiment involving a factorial arrangement of treatments. Treatments will be applied in a split-split-plot design, with elevation being the whole-plot effect, planting being the sub-plot effect, and herbivore grazing being the sub-sub-plot effect (see Fig. 1). Two-acre experimental areas will be randomly established in Blackwater NWR and on Tudor Farms land in

deteriorating marsh (in or near areas that contain some emergent vegetation) that will receive all combinations of the following treatments, each replicated five times:

- *Elevation*
  - no sediment applied (five 2-acre experimental areas)
  - 1-2 inches applied using thin layering (five 2-acre experimental areas)
  - 3-4 inches applied using thin layering (five 2-acre experimental areas)

- *Planting*
  - no planting (one 1-acre plot within each experimental area)
  - planted with Olney's three-square (*Scripus americanus*) (one 1-acre plot within each experimental area)

- *Nutria grazing*
  - unfenced (one 2500 $ft^2$ subplot within each 1-acre plot)
  - fenced to exclude nutria (one 2500 $ft^2$ subplot within each 1-acre plot)

Logistically, this experimental design will involve thin-layer sediment deposition for 20 acres, planting of 15 acres, and construction of 30 nutria exclosures. Growth, coverage, and quantity of vegetation in each plot will be measured monthly during the growing season for three years using measurements including stem density, height, coverage, leaf area index, and standing biomass. To elucidate underlying mechanisms controlling the observed responses in vegetation, environmental parameters such as salinity, nutrient concentration, soil organic matter content, soil redox potential, and canopy light penetration will also be monitored.

**Benefits of the Wetland Restoration Demonstration Project**

This study will provide a visual and statistical demonstration of the effectiveness of sediment deposition and planting, both in the presence and absence of nutria herbivory, and will help demonstrate the importance of nutria eradication to the restoration of emergent wetlands along the Blackwater River. The factorial arrangement of treatments also allows for quantifying of interactions among factors (e.g., does adding sediment produce the same effect if nutria are present and/or the area is planted?). This information will be directly applicable to designing and implementing large-scale wetland restoration projects in coastal marshes of the Mid-Atlantic region and elsewhere. Additionally, this project will have the substantive benefit of restoring several acres of deteriorated coastal marsh.

**Literature Cited**

Baldwin AH, McKee KL, Mendelssohn IA (1996) The influence of vegetation, salinity, and inundation on seed banks of oligohaline coastal marshes. *Adv Bot Res* 83:470-479

Baldwin AH, Mendelssohn IA (1998) Effects of salinity and water level on coastal marshes: an experimental test of disturbance as a catalyst for vegetation change. *Aquat Bot* 1250:1-14

Boesch DF, Josselyn MN, Mehta AJ, Morris JT, Nuttle WK, Simenstad CA, Swift DJP (1994) Scientific assessment of coastal weland loss, restoration and management in Louisiana. *J Coastal Res* SI20:1-103

Ford MA, Cahoon DR, Lynch JC (1998) Restoring marsh elevation in a rapidly-subsiding salt marsh by thin-layer deposition of dredge material. *Ecological Engineering* (in press)

Galinato MI, van der Valk AG (1986) Seed germination traits of annuals and emergents recruited during drawdowns in the Delta Marsh, Manitoba, Canada. *Aquat Bot* 26:89-102

McKee KL, Mendelssohn IA (1989) Response of a freshwater marsh plant community to increased salinity and increased water level. *Aquat Bot* 34:301-316

Stevenson JC, Kearney MS, Pendleton EC (1985) Sedimentation and erosion in a Chesapeake Bay brackish marsh system. *Mar Geol* 67:213-235

Stevenson JC,Kearney MS (1996) Shoreline dynamics on the windward and leeward shores of a large temperate estuary. In: Nordstrom KF, Roman CT (eds) Estuarine shores: evolution, environments and human alterations. John Wiley & Sons Ltd

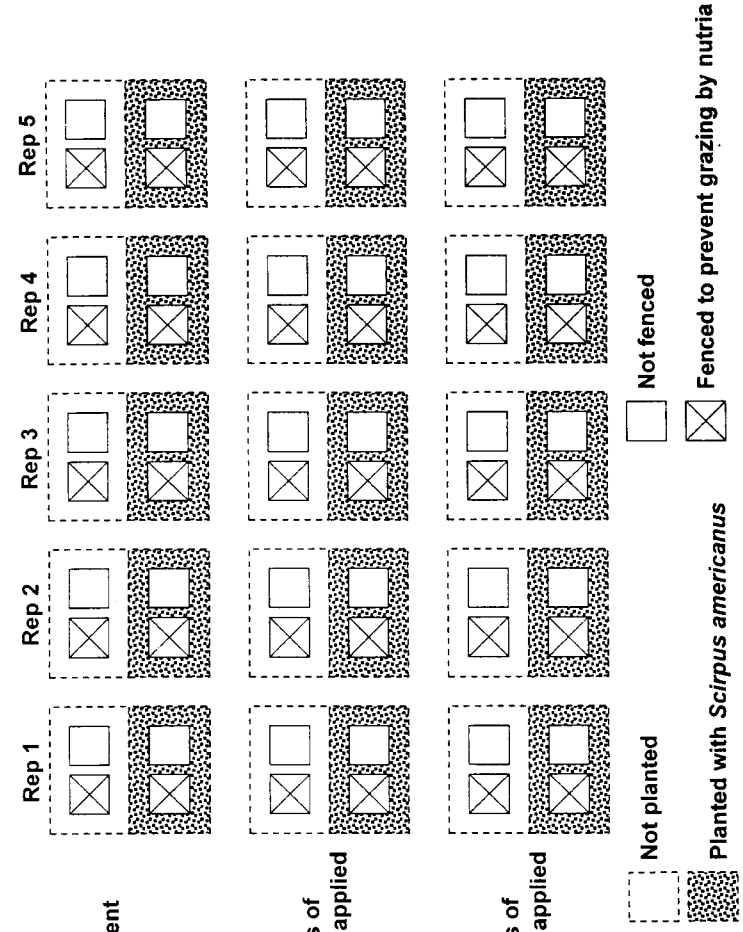



Fig. 1. Schematic of experimental design for the Wetland Restoration Demonstration Project. The actual location of experimental plots will be randomly selected.

# *Wetland Restoration Demonstration Project*

A component of the pilot program entitled

Marsh Restoration: Nutria Control in Maryland

Andrew H. Baldwin, Ph.D.
Dept. of Biological Resources Engineering
University of Maryland
College Park, MD 20742-5711

Tel 301/405-1198
Fax 301/314-9023
E-mail ab174@umail.umd.edu

## Objectives

- Demonstrate that nutria eradication will enhance restoration of wetlands
- Investigate the effects of increasing marsh elevation and planting of native species on restoration success
- Support design and implementation of large-scale restoration programs for coastal marshes subject to nutria grazing and coastal submergence

## Factors controlling marsh deterioration

- Grazing by nutria
  - leaf and root damage
  - removal of plant growth resources
- Coastal submergence
  - increase in relative water level due to land subsidence (sinking) and sea level rise (currently 1-2 mm/yr)
  - reduces plant growth, inhibits seed germination
- Combination of grazing and submergence can kill wetland plants, causing wetland loss

## Wetland restoration

- Nutria eradication is one component
- Other important components?
  - Increase sediment elevation
    - reduce submergence
    - promote plant growth and colonization
  - Planting of vegetation
    - speed reestablishment of desirable plant communities
    - reduce colonization by invasive plant species such as *Phragmites australis* (common reed)

## Increasing marsh elevation using thin-layer sediment deposition

- Sediment is pumped from the channel bottom through a sprayer and deposited in a layer on marsh surface
- Operates in 2-4 ft of water
- Pumps organic or mineral sediment up to 2500 ft away
- Can apply to both vegetated and non-vegetated areas
- Successfully used to restore coastal marsh in Louisiana

## Technical approach

- Establish 2-acre areas in deteriorated marshes that receive no sediment, 1-2 inches of sediment, or 3-4 inches of sediment applied using thin-layer deposition
- Plant half of each area with Olney's three-square (*Scirpus americanus*), a desirable native marsh species
- Fence a portion of each planted and unplanted area to prevent nutria grazing
- Monitor vegetation and environmental parameters to evaluate restoration success

## Expected results of the Wetland Restoration Demonstration Project

- Visual and scientific demonstration of effects of nutria eradication, sediment elevation, and planting on restoration success
- Findings directly applicable to designing and implementing large-scale wetland restoration projects
- Several acres of deteriorated coastal marsh will be restored

USGS
science for a changing world

# South American Nutria Destroy Marsh Habitat

*Through a collaborative partnership with the State of Maryland and the US Fish and Wildlife Service, USGS Patuxent Wildlife Research Center scientists are investigating the role of South American nutria in the extensive loss of marsh at the Blackwater National Wildlife Refuge. Findings indicate that overpopulation and destructive foraging habits are accelerating marsh loss.*

## INTRODUCTION

Accidentally introduced to Maryland's eastern shore marshes in the early 1940s, the South American nutria (Myocastor coypus) established large populations that are implicated in the loss of emergent brackish marsh. Areas dominated by the plant Olney 3-square (Scirpus americanus) are disappearing along the Blackwater River and adjacent river systems in Dorchester County. Loss of marsh has coincided with introduction and expansion of the nutria population. Marsh loss was noticeable in the region from photographs as early as the 1950s and has accelerated to the present. The effect of nutria foraging on marsh vegetation has escalated over the past two decades with a severe decline in fur values and lack of incentive to harvest animals by traditional trapping methods. A recent study found that within the US Fish and Wildlife Service's Blackwater National Wildlife Refuge alone, ***over 6 square miles of marsh have been lost to open water since 1938 and 53 percent of remaining marsh has suffered significant damage and will likely be lost in the near future.***

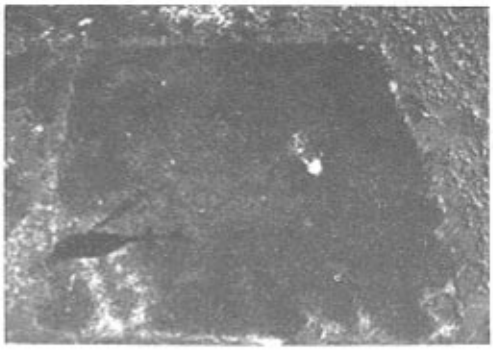
Marsh loss along the Blackwater River in Dorchester County, Maryland, has accelerated since the 1950s. What was once continuous marshland now appears as fragmented remnants (above). Over 6 square miles of marsh have been lost to open water since 1938.

Nutria are large (8-18 lb) beaver-like rodents introduced from South America. Overpopulation has resulted from a decline in the fur industry and a lack of any other apparent market for the animals. Nutria are 5 to 10 times as large as our native muskrat.

## A USGS, MARYLAND-DNR, US FISH AND WILDLIFE SERVICE PARTNERSHIP

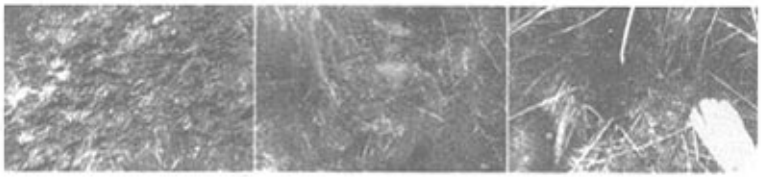
The USGS Patuxent Wildlife Research Center, Maryland Department of Natural Resources, and Blackwater National Wildlife Refuge teamed up in 1995 to investigate the relationship between nutria foraging activity and marsh loss. The resulting study is using large fenced exclosures to experimentally test whether removal of nutria can stabilize or recover emergent vegetation. Twenty large 100 ft x 100 ft exclosures were established in

the marsh requiring 1.5 miles of fencing; an additional 38 unfenced control plots also were established. Vegetative response was monitored through spring and fall measurements of 346 fixed subplots and aerial photography of whole plots.



Large 100 ft x 100 ft exclosure, showing good recovery of vegetation in the absence of nutria grazing.

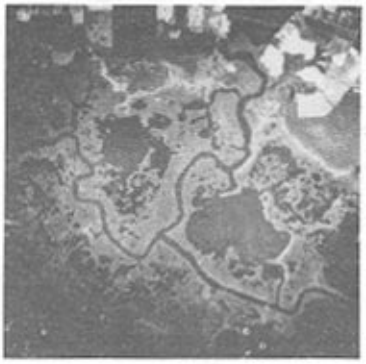
Preliminary results following one growing season indicate moderate expansion of vegetation in fenced exclosures and continued decline of vegetation in unfenced controls. This is the first scientific evidence that 1) nutria activity is directly contributing to marsh loss in Maryland, and 2) the marsh has some capacity to recover in the absence of nutria. However, because of the vulnerability of the denuded marsh surface to erosion, it appears that only partial recovery of marsh vegetation is possible without some restoration action to fill in eroded areas or otherwise raise the marsh surface to a level that allows plants to grow. A number of growing seasons is required before more definitive statements about recovery potential are possible. The overabundance of nutria, the extensive loss of marsh, and the failure of traditional harvest methods to control nutria numbers have prompted the Maryland Department of Natural Resources to consider a program of eradication for this invasive, exotic species.



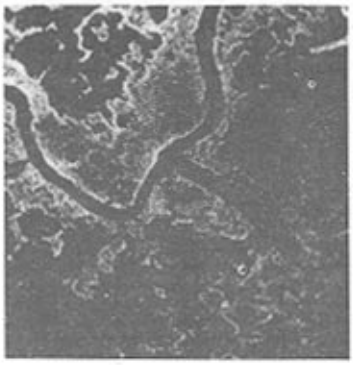
Nutria sign is everywhere in the marsh, including abundant tracks (left), foraging "eatout" areas (center, right). All are testimony to an overabundance of nutria in this marsh.

Foraging directly on the root mat of vegetation, nutria cut up the marsh into finer and finer fragments (left, center). Erosion by tidal currents and wave action lowers denuded marsh surface and inhibits plant recolonization (right).

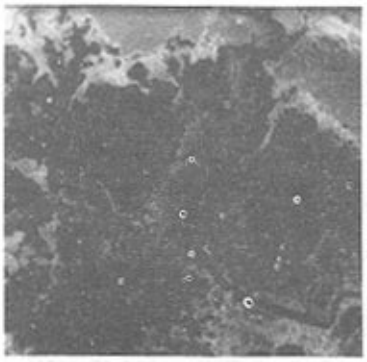
Juncture of Big and Little Blackwater Rivers,
Dorchester County, Maryland



1938



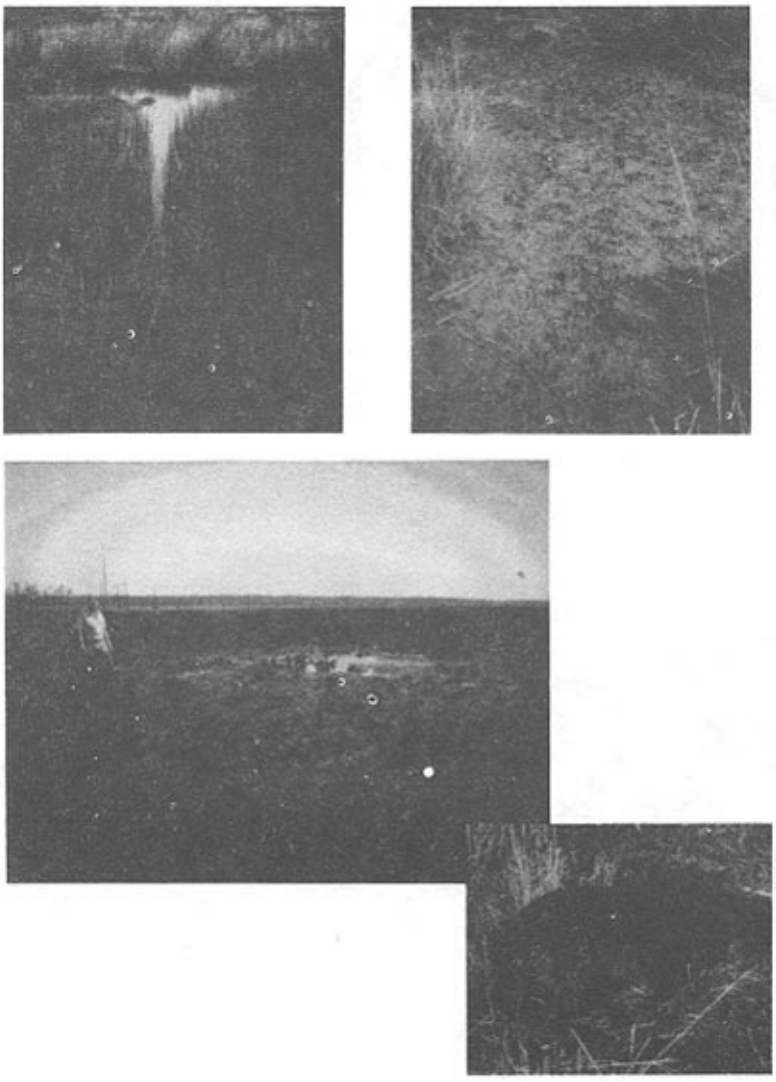
1957



1972

1989

Nutria Damage at Blackwater NWR



**STATEMENT OF MR. GREG LINSCOMBE**
**Louisiana Department of Wildlife and Fisheries**

---

**Introduction**

The Louisiana Department of Wildlife and Fisheries (LDWF) appreciates the opportunity to provide testimony for the record for the hearing held by the House Subcommittee on Fisheries Conservation, Wildlife and Oceans on July 16, 1998, regarding the control of nutria. While the Department recognizes that the purpose of this hearing is to discuss the serious problem of nutria damage on the Blackwater National Wildlife Refuge in Maryland, the Department wishes to call to the attention of the Members of this Committee that the control of nutria in Louisiana is among the top priorities of the State of Louisiana where over 3.3 million acres of coastal wetlands now exist. This is the largest expanse of wetlands in the contiguous U.S., comprising 25% of the freshwater marshes and 69% of the saltwater marshes of the Gulf Coast. This translates to 15% and 40% of these ecotypes remaining in the United States. Wetland damage in Louisiana attributable to nutria is now conservatively estimated to exceed 80,000 acres in the Southeast portion of the state. State and federal efforts to restore wetlands under the Coastal Wetlands Planning Protection and Restoration Act and future anticipated programs could ultimately fail if simultaneous efforts to effectively control nutria populations are not adequately funded and implemented. The Department hopes that the Committee will seriously consider holding a future hearing in Louisiana on the issue of nutria damage and control to protect our nation's largest and most valuable wetland resources.

The nutria (Myocastor coypus) is a large semi-aquatic rodent indigenous to South America. The first introduction of nutria occurred in California in 1899, however it was not until the 1930's that additional animals were introduced in seven states. These importations, primarily for fur farming, failed during the Second World War as a result of poor pelt prices and poor reproductive success. Fifteen states now have feral populations of nutria established.

The Gulf Coast nutria population originated in Louisiana in 1937 from 13 animals imported by from Argentina by E. A. McIlhenny. After numerous escapes in earlier years, approximately 150 nutria escaped during a hurricane in 1940. McIlhenny expected that the animals would perish in a few days because of high alligator densities in the surrounding marshes, but the nutria survived and by 1956, the annual harvest

was 419,000. Populations first became established in the western portion of the state then later spread to the east through natural expansion as well as stocking. During the mid-1950's muskrat populations were declining, nutria had little fur value, and serious damage was occurring in rice fields in southwestern Louisiana and sugarcane fields in southeastern Louisiana. The nutria problem became critical with rice and sugarcane farmers complaining about damage to crops and levee systems and muskrat trappers blaming the nutria for declining numbers of muskrats. In 1958, the Louisiana Legislature placed the nutria on the list of unprotected wildlife and created a $0.25 bounty on every nutria killed in 16 south Louisiana parishes, but never appropriated the funds.

Research efforts were initiated by the federal government in the southeastern sugarcane region of the state to determine what control techniques might be successful. This research conducted by the U.S. Fish and Wildlife Service during the 1960's examined movements in relation to sugarcane damage and recommended shooting, trapping, and poisoning in agricultural areas. Ted O'Neil, Chief of the Fur and Refuge Division, LDWF, believed that the problem could only be solved through the development of a market for nutria pelts. A market for nutria developed slowly during the early 1960's and by 1962 over 1 million pelts were being utilized annually by the German fur trade. The nutria surpassed the muskrat in 1962 in total numbers harvested and has remained the backbone of the Louisiana fur industry since that time. In 1965, the state legislature returned the nutria to the protected list. As prices showed a slow rise during most of the 1970's and early 1980's, the harvest averaged 1.5 million pelts and complaints from agriculture became uncommon. From 1971 through 1981 the average value of the nutria harvest to the coastal trappers was $8.1 million. The nutria harvest in Louisiana from 1962 until 1982 remained over 1 million annually. In 1976 the harvest peaked at 1.8 million pelts worth $15.7 million to coastal trappers.

However, the market began changing during the early 1980's. In 1981-82 the nutria harvest dropped slightly below 1 million. This declining harvest continued for two more seasons, then in 1984-85, the harvest jumped back up to 1.2 million. During the 1980-81 season, the average price paid for nutria was $8.19. During the 1981-82 season, the price dropped to $4.36, then in 1982-83, the price dropped to $2.64. Between the 1983-84 season and the 1986-87 season, prices fluctuated from slightly over $3.00 to slightly under $4.00. Then in 1987-88 and again in 1988-89 prices continued to fall (Figure 1). From 1982 through 1992 the average value of the nutria harvest was only $2.2 million. Between 1988-89 and 1995-96 the number of nutria harvested annually remained below 300,000 and prices remained at or below a $3.00 average.

Reports of marsh vegetation damage from land managers became common again 1987 after 28 years of no problems. Such complaints became routine by 1988 and the Fur and Refuge Division, LDWF initiated limited aerial flights, particularly in southeastern Louisiana. These flights showed that damage was occurring, but the

severity, distribution, and duration of the damage was unknown.

The first region-wide aerial survey became possible because of the interest and concern of many state and federal agencies, coastal land companies and, in particular, funding provided by the Barataria-Terrebonne National Estuary Program (BTNEP). The objective of the aerial survey was to: (1) determine the distribution of damage along the transect lines as an index of damage region wide, (2) determine the severity of damage as classified according to a nutria relative abundance rating, (3) determine the species of vegetation being impacted and (4) determine the status of recovery of selected damaged areas.

Helicopter surveys were flown in May and December 1993 and again in March and April 1996 across the Barataria -Terrebonne Basins. During the December 1993 survey 90 damaged sites were observed amounting to over 15,000 acres of marsh impacted along the transects and extrapolated, estimated at 60,000 acres across the study area. In 1996, a total of 157 sites were observed. The damage observed along the transects lines increased to 20,642 acres and extrapolated, estimated at over 80,000 acres. Of all the 1993 sites evaluated again in 1996, only 9% showed any recovery. Clearly, the trend identified, was a continued increase in both the number of sites and the extent of nutria damage in the Barataria-Terrebonne Basins.

Vegetative damage caused by nutria has been documented in at least 11 Coastal Wetlands Planning Protection And Restoration Act (CWPPRA) project sites in the Barataria-Terrebonne Basins (covering much of Southeast Coastal Louisiana-see attached map). The estimate of 80,000 acres of marsh damaged is conservative because only the worse (most obvious) can be detected from aerial surveys. The number of acres being impacted is certainly much higher. When vegetation is removed from the surface of the marsh, as a result of over grazing by nutria, the very fragile organic soils are exposed to erosion through tidal action. If damaged areas do not revegetate quickly, they will become open water as tidal scour removes soil and thus lowers elevation. Frequently the plants roots systems are also damaged, making recovery through vegetative regeneration very slow.

Certainly the problems being addressed in coastal restoration are major challenges. Nutria herbivory may be minor compared to the other factors causing wetlands loss, but the additional stress placed on the plants, by nutria herbivory, may be very significant in CWPPRA projects sites.

State and federal agencies, reviewing the results of aerial surveys considered and approved last year a five year CWPPRA Demonstration project entitled-"Nutria Harvest and Wetland Demonstration Project". The basic concept is to utilize this funding to develop national and international markets for nutria meat for human consumption. Nutria meat has been considered a delicacy in Europe for many years and nutria meat

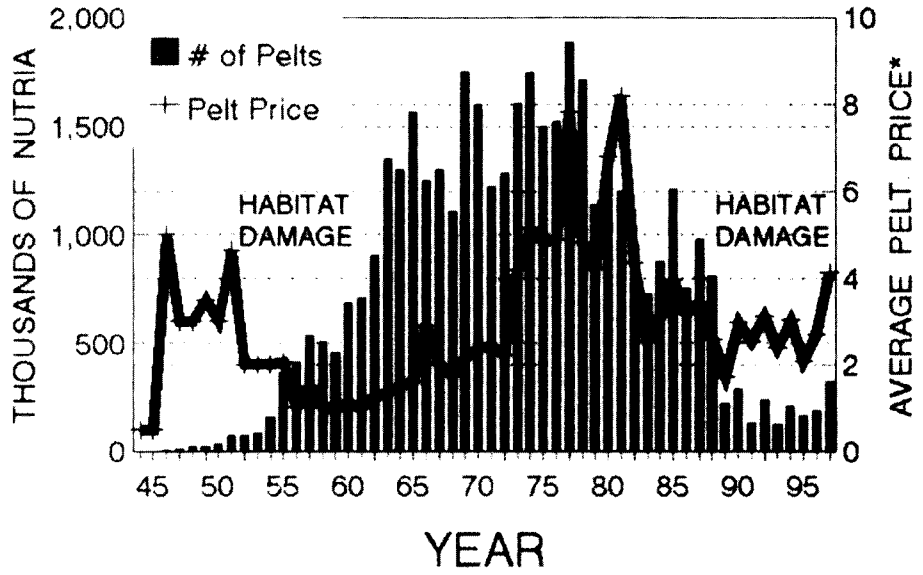
(Ragoudin) from farms is served in many restaurants. During the mid 1980's six to eight million pounds of meat were being consumed each year in Europe. In addition to market development, funds will be used to provide payments to trappers for every nutria delivered to a licensed processor and payments to processors for every pound of nutria meat sold. The Department has completed several promotional projects including participation in the largest food show in Asia during this past Spring. This fall and winter will be the first trapping season during which payments will be made. This CWPPRA Demonstration Project will provide $2 million during the next four years. At the end of this project nutria meat markets, if profitable, should continue on their on adding, additional incentive to keep more trappers in the marsh helping to maintain nutria populations in balance with habitat.

The Department and the Louisiana Fur and Alligator Advisory Council (created by Legislative Act in 1986) continue to work on fur market development and enhancement programs internationally. The objective of these marketing efforts has been to find new markets for Louisiana nutria and to strengthen existing markets to increase prices paid to trappers. During the past nine years, the Fur and Alligator Advisory Council, working through the Department with dedicated state funds (including a portion of trapper license fees), has spent approximately $800,000 enhancing and developing new fur markets. During the last two seasons prices paid for nutria have increased significantly and the harvest has been over 350,000 animals. These harvest are the largest since 1988-89. Good prices paid to trappers maintained control of the nutria population in Louisiana for twenty years (1962-1982) and prevented damage to wetlands and agriculture.

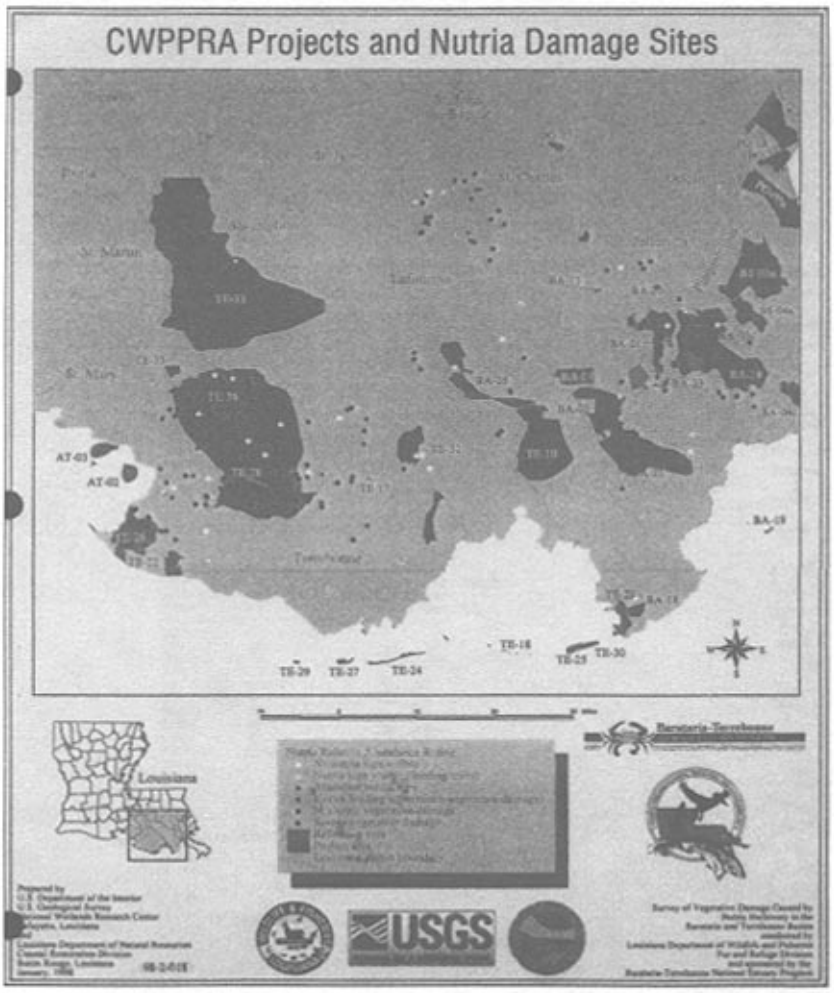
Both the meat and fur programs appear to hold the potential for some success and may work if new fur markets can be sustained and if meat markets can be developed, but we must consider expanding marketing programs for fur and meat as well as exploring other approaches to insure control of nutria in coastal Louisiana. To accomplish this we will certainly need information that will be provided by this pilot project in Maryland and we will undoubtedly need the support of Congress to consider appropriate programs for Louisiana.

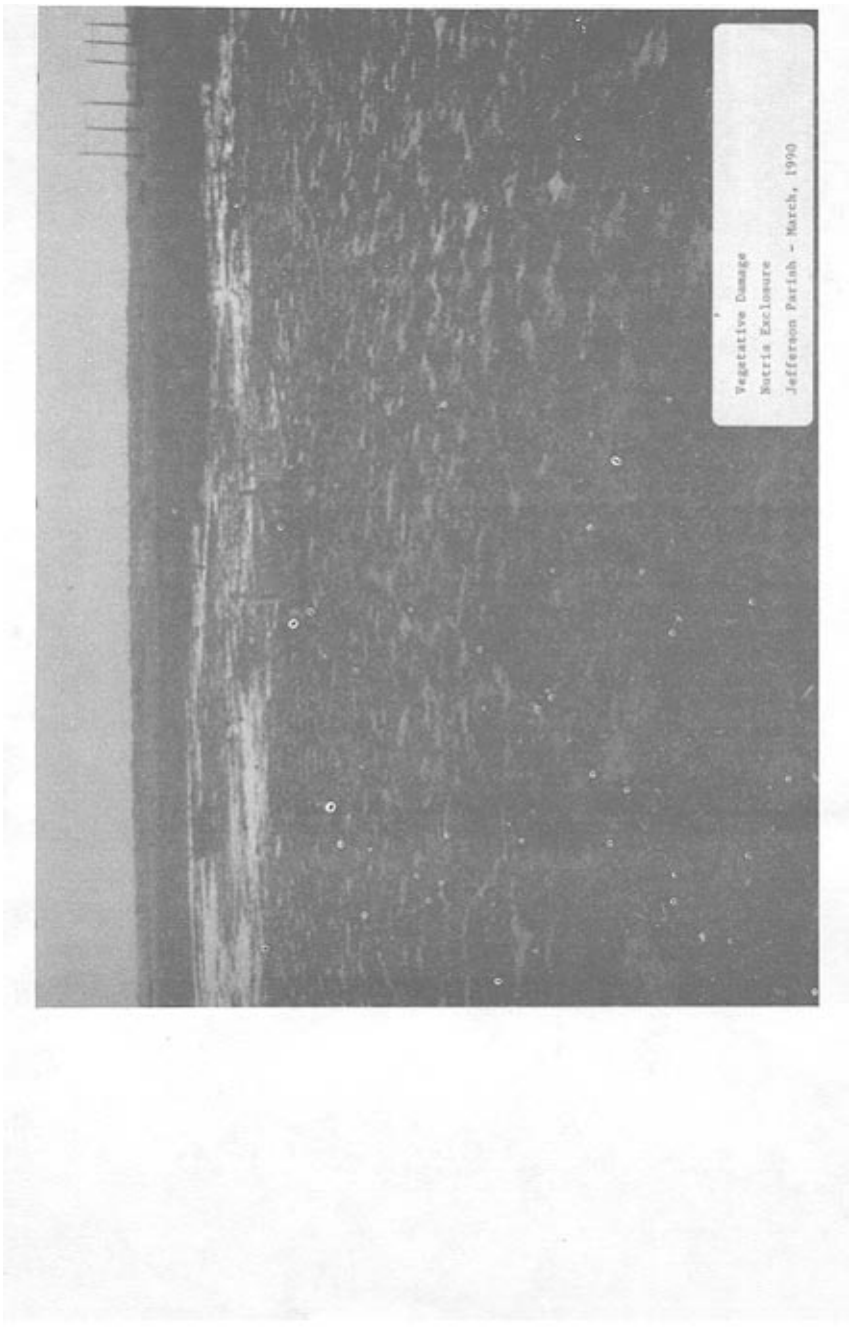
# LOUISIANA NUTRIA INDUSTRY

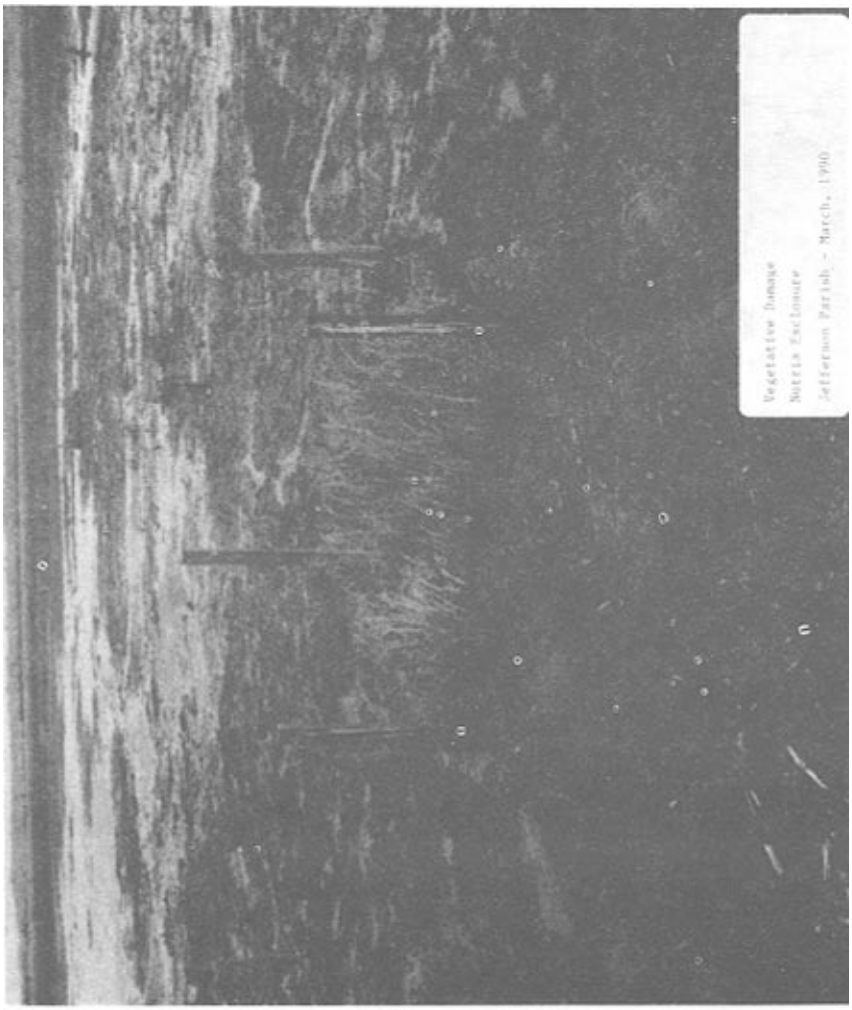
## HARVEST AND AVERAGE PELT VALUE

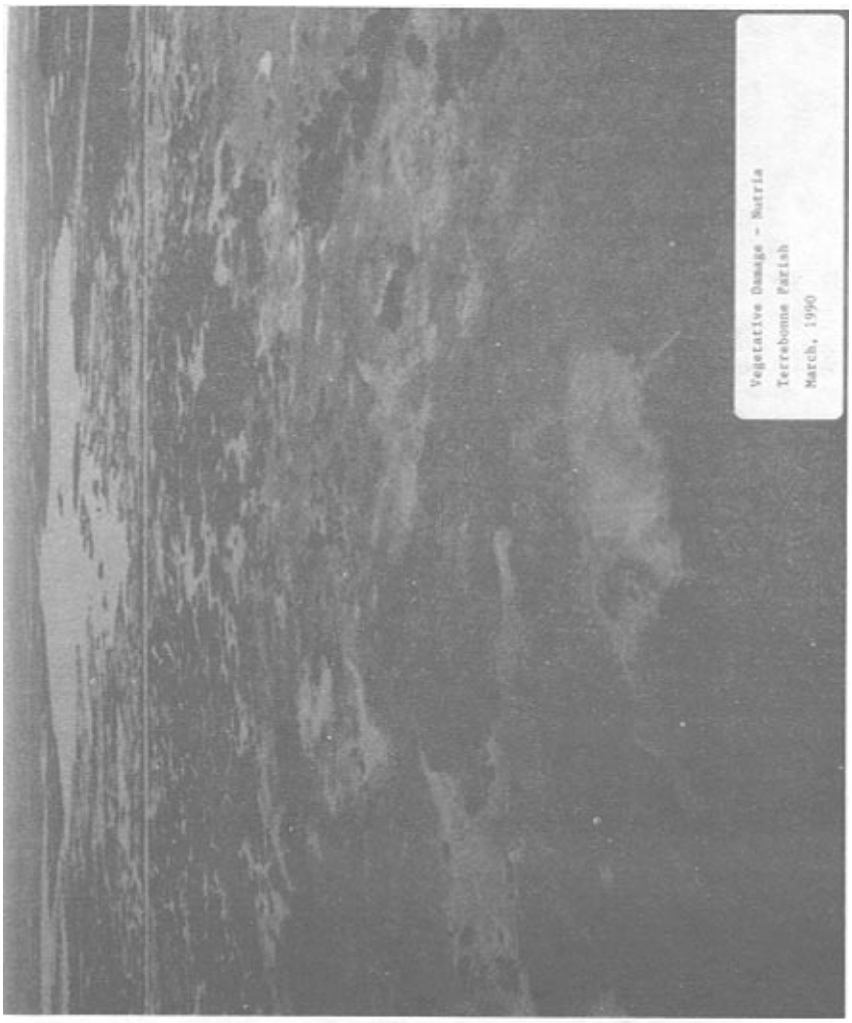


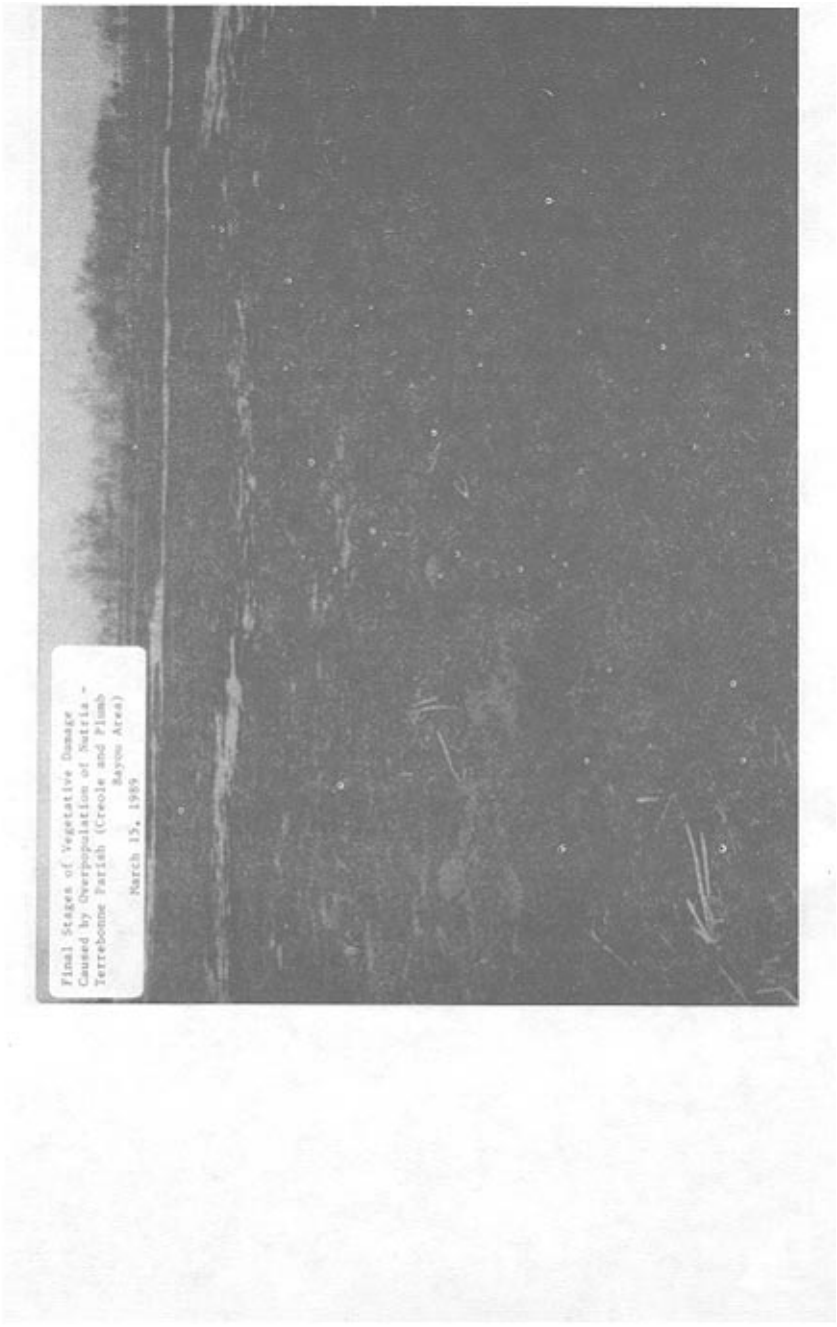

* PRICE IN U.S. DOLLARS


CWPPRA Projects and Nutria Damage Sites
St. Mary
AT-03
AT-02
TE-39
TE-27
TE-24
TE-18
TE-25
TE-30
Louisiana
USGS

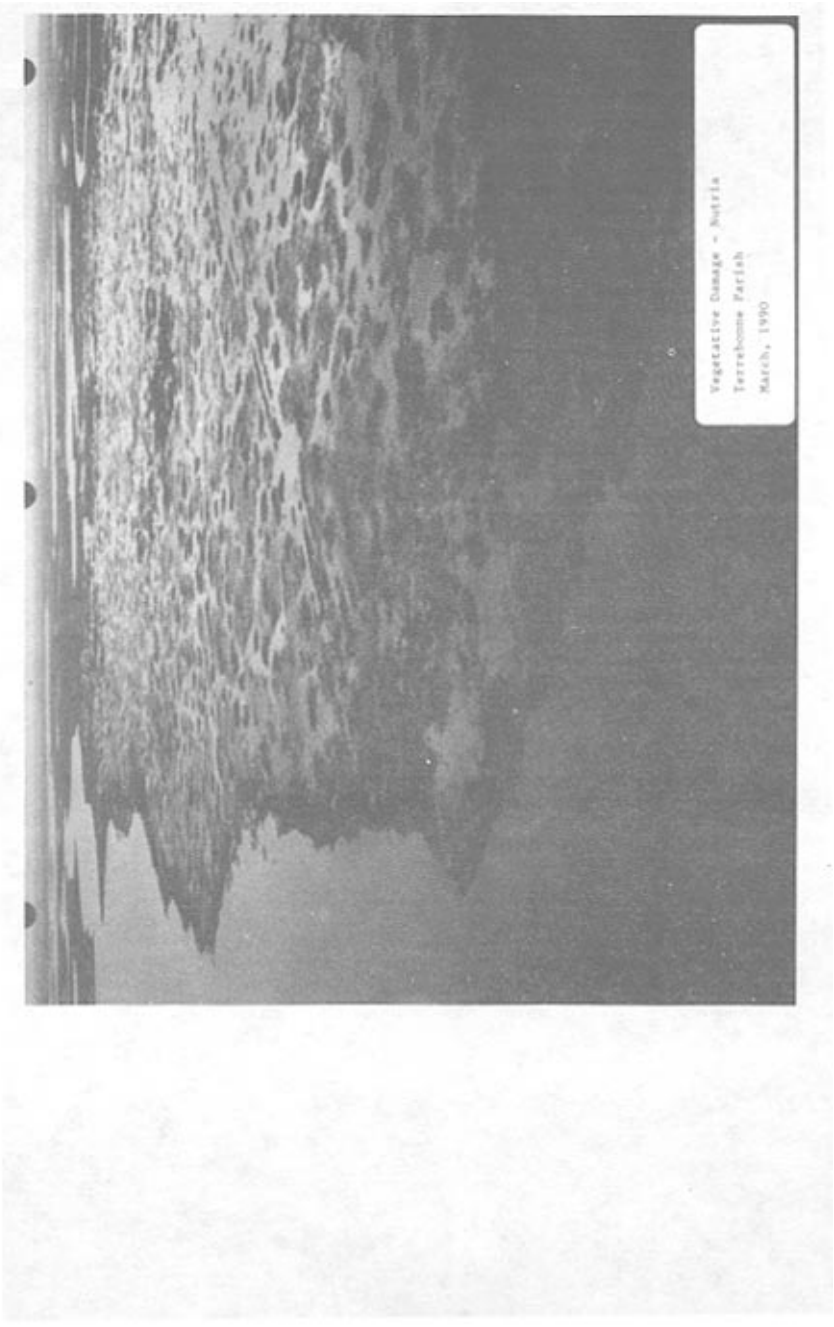

Vegetative Damage
Nutria Exclosure
Jefferson Parish - March, 1990


Vegetative Damage
Notria Enclosure
Jefferson Parish - March, 1990


Vegetative Damage - Nutria
Terrebonne Parish
March, 1990



Final Stages of Vegetative Damage
Caused by Overpopulation of Nutria -
Terrebonne Parish (Creole and Plumb
Bayou Area)
March 15, 1989


Vegetative Damage - Nutria
Terrebonne Parish
March, 1990